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TO COME

That Pre-Cambrian Shield

IS THE famous Pre-Cambrian shield in Canada one vast storehouse of mineral wealth, as many boosters would have us think? C. M. Campbell, a well-known Canadian engineer, has his doubts, cogently expressed in an article "Pre-Cambrian Misconceptions." One does not need to be a high-brow geologist to appreciate what Mr. Campbell writes.

Copper Smelting

THE next instalment of "Revisiting Arizona Mining Camps" will be devoted to what is going on at the Hayden plant of the A. S. & R. It is too hot to visit this plant now except by proxy. The smelter superintendent writes that he is getting a wonderful fuel ratio by using pre-heated air in the reverbs: it is 110 deg. in the shade.

Cyaniding or Flotation?

HOW many gold miners, as they progress from an oxidized to a sulphide zone, have to make this decision! The solution worked out at the Cortez mine, in Nevada, shows the gain made by a change in practice.

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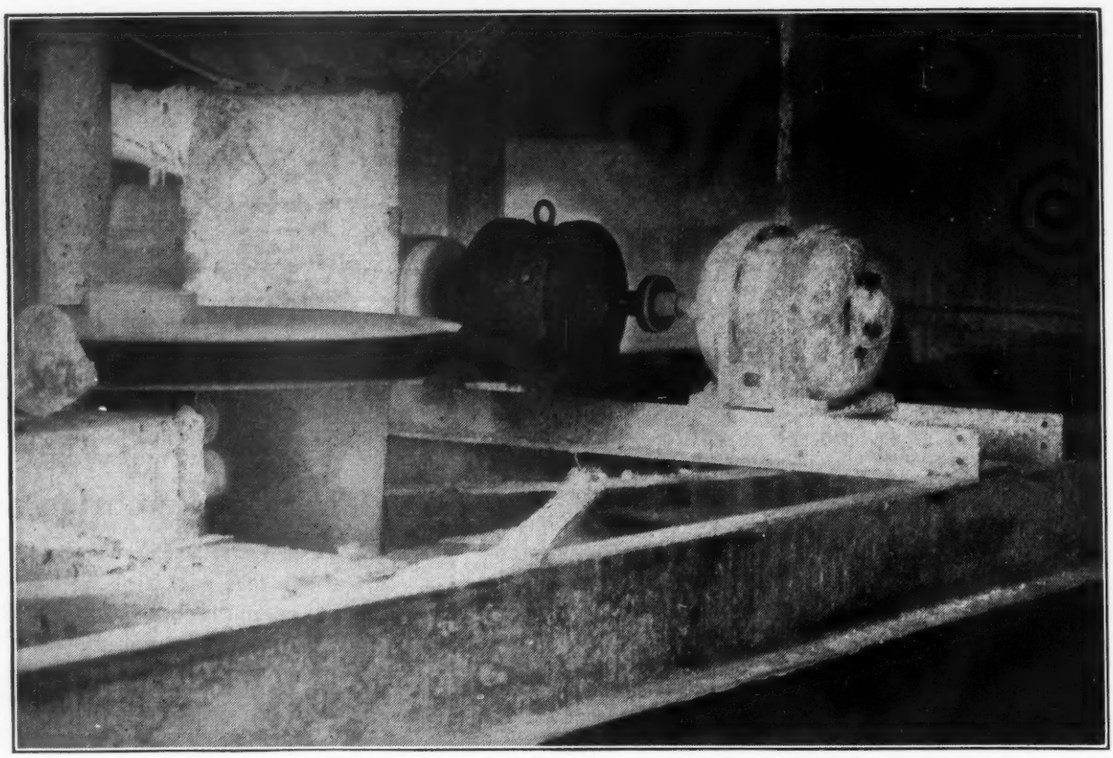

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ENGINEERING AND
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VOLUME 126 — *New York, July 28, 1928* — NUMBER 4

The Investing Public and the Mining Engineer

ON SEVERAL OCCASIONS *Engineering and Mining Journal* has insisted that capitalists, including those with comparatively small resources, should investigate before buying stock in an undertaking of which they have no technical knowledge. A lack of technical knowledge of mining is widespread, as is also the desire to acquire riches overnight. The outcome is that the unwary investor too frequently loses his money, the venture passes into oblivion, and the promoter and his associates are the only gainers. Legitimate mining investment receives another black eye.

The general lack of technical knowledge on the part of the investing public is no handicap, however, if it be realized that examining and consulting engineers are available in almost every section of the country, experienced and qualified to give an opinion on the status of a property and the reputation of the promoters and their advisers. Unfortunately, the mining engineering profession in the United States is under no disciplinary control from a national organization, as it is in some other countries, with the result that almost anyone may pose as a mining engineer, and issue reports designed to stimulate the flow of capital in the direction of a specific promotion, regardless of its intrinsic worth.

The business of mining in California is supposed to be subjected to special safeguards because of a system of control, by the State Corporation Department, of stock issued, yet misrepresentation is still the working tool of one type of promoter, with the result that legitimate enterprise suffers in proportion to the success of his efforts. Lack of technical direction and control is obvious to an engineer, but passes unnoticed by the unsophisticated layman who is urged to invest. A case in point is that of the Corona Mining Company, alleged owner of claims in Lassen County, California. "An Open Letter to the Public," appearing in a recent issue of "Underground," published in San Francisco, gives the company's sub-title as "Watch Our Smoke," which is ironic in inferred prophecy. The mines, according to the letterhead, contain copper, gold, silver, and aluminum.

An investor immediately connects aluminum with great wealth, calling to mind the magnitude of the operations of the Aluminum Company of America and the riches of Mr. Andrew W. Mellon, the Secretary of the Treasury. The layman does not know, however, that aluminum is widely distributed throughout the earth's crust in the form of common clay. He is inveigled by the claims of the Corona Mining Company that its property contains aluminum, which is true, but a circumstance of no economic significance whatever.

The next step taken by the promoter is to introduce the "consulting engineer." In this respect, "Underground" is willing to co-operate, publishing as a technical article some advice on "Cyanidation for the Small Operator," which if acted upon without amplification or correction would lead to disappointment or hopeless failure. The authors of this effusion, however, are apparently the technical advisers to the Corona Mining Company, advertising on another page, which contains a report signed by them, summarizing conclusions based on an alleged examination of the ore and, perhaps, of the mines. Referring to a concentration test, the report states that "The total extraction of copper is 21.2 per cent. Extraction of silver 31.5 per cent. Extraction of gold 51.5 per cent. There is over 44 feet of 16.4 per cent aluminum in sight. It is quite evident that this ore cannot be treated by gravity concentration, as the copper minerals float very rapidly. It is ideal ore for oil flotation, and we are certain that a high percentage of extraction together with a marketable grade of concentrates can easily be obtained."

Over 44 feet of 16.4 per cent aluminum in sight! The ignorant investor is dazzled with this new opportunity for the acquisition of wealth. To him, anyone who calls himself a mining engineer is, *ipso facto,* a mining engineer. He is as helpless as a babe in the evaluation of technical merit in such a report or in estimating the professional standing of its signatories.

It may be argued that the individual desiring to speculate on a small scale cannot afford to employ a mining engineer to advise him. It is true that he cannot afford the expense of a special mine examination, but the average reliable engineer can easily "spot" the earmarks of a fraud by a casual examination of a prospectus, and he usually is aware of the facts in connection with a stock-jobbing scheme. He generally is willing to advise an intending investor for a nominal fee; he should be, if for no other reason than to protect the good name of the industry in which he is engaged.

Directors of Teck-Hughes Decide to Sink to 7,000 Feet

TECK-HUGHES continues to upset all calculations. The recent announcement that its directors have decided to sink to 7,000 feet comes as a great surprise. Other operators in Kirkland Lake may congratulate themselves that the doughty Teck has assumed the burden of proving the district at depth. No halfway measures are these. The present Central shaft reaches only to the nineteenth level, about 2,300 feet. At the completion of the three-year program now mapped out the company will have a fair idea of how far in front of it its future reaches.

It is unlikely that Teck-Hughes will have competitors for the honor of being the first to reach what will be the deepest mining level in North America. Nothing so foolish as a race to please the brokers and the public is

expected. Sinking is costly. At Porcupine, McIntyre's new No. 11 shaft, 4,200 feet deep, cost $2,000,000 with its equipment, and took two years to sink. Teck-Hughes probably expects to make faster time. Its project, of course, is rather different.

Pioneering of this sort at depth is admirable. Further laurels might also be gained by metallurgical research. If Teck-Hughes, besides seeking to disclose increased reserves, will show the way to decreasing the amount of gold dumped into the near-by lake with the tailings from its own and its neighbors' mills, it will be doing something even more worth while. At the same time, it will lessen the amount of re-treatment to be accomplished in the future. The Teck-Hughes management, of course, has realized that losses are high and has endeavored to reduce them, but with rich ore the incentive is not so great.

How Much Longer? Members of the Copper Institute

IN ITS ISSUE of July 19 the *Boston News Bureau*—regarded as the last word in copper matters in the Hub city—printed an editorial on the "Stabilization of the Copper Industry," assigning an important rôle in its accomplishment to the Copper Institute. If not categorically, at least by clear inference, the Institute is given credit for taking the "mystery" out of the copper industry by collecting and making public "figures of production from mine, smelter, and refinery, . . . shipments to home and foreign consumers," and refinery stocks. Everybody interested in the matter knows that these data are compiled and distributed by the American Bureau of Metal Statistics, and that they have been for years. For a time the refinery stocks were made public only at quarterly intervals, but since November, 1925, the monthly figures have been published.

Is the *Boston News Bureau* so badly informed as not to know the difference between the Institute and the Bureau, or is it knowingly misrepresenting the fact? If not, the officials of the Copper Institute have given the *Boston News Bureau* information to the exclusion of ourselves and others who have been given specific promises by the officials of the Institute that they would receive any and all data and reports issued to other than member companies. We have received nothing, and in view of the assurance given us we doubt whether the *Boston News Bureau* has.

This seems a good juncture at which to direct the attention of the officials of the Institute to the following article in its constitution:

> ARTICLE 4. The books and records of the Institute shall be open at all times to the inspection of the departments or bureaus of government interested, and all reports distributed to members shall be furnished to any official public body or institution desiring to receive them. The information compiled by the Institute, in essential particulars, shall be available to the public through trade journals or the general press.

We are fully aware of the fact that some of the member companies are not reporting current business in complete detail; that the compiling and aggregating of the data are an extremely complicated task; and that the results might be misinterpreted by one who did not view them in the light of complete knowledge as to which of the companies were making no returns, or incomplete returns. Nevertheless, eight months has elapsed since the Institute started to function, and regular reports are being made to the members. In view of its avowed policy of taking the public into its confidence, and of the natural suspicion that always is aroused by secrecy in a situation of this kind, *Engineering and Mining Journal* urges the Institute to establish the practice of making public periodical reports of some character at the earliest possible moment.

Dr. Smith Diagnoses Our Industrial Ills—And Proposes a Remedy

MARKEDLY in the public interest is the analysis of our industrial situation and the suggested remedies embodied in the address of Dr. George Otis Smith before the section of Mineral Law of the American Bar Association, at Seattle, Washington, on July 24. That Dr. Smith's deductions and his advice are in harmonious accord with the expressed opinions of other distinguished representatives of our business and industrial life adds weight and luster to his declarations. His address is made available to our readers in this issue, with minor omissions which space limitations have imposed.

Obviously, it is to the representatives of the Law that Industry must address itself if the obsolete governmental machinery that hampers its development, self-control, and evolution is to be scrapped: for both Congress, in which the preponderance of legalists is overwhelming in more senses than one, and the judiciary, which has the final say on all matters of love, liberty, life, and license, must be convinced of the imperative need for change before Industry may be freed from the shackles imposed by the lawgivers of other days.

The occasion of Dr. Smith's presentation of the result of his study of Industry and Government was colored with some measure of romantic interest by the fact that an illustrious predecessor, Dr. Rossiter W. Raymond, for long an official of the A.I.M.E., and the first editor of the *Engineering and Mining Journal,* in his initial official report to the Government on the mines of the West, had pointed out that, "Governments are in a certain sense trustees of the wealth stored in the mineral deposits of their realms—trustees for succeeding generations of their own citizens and for the world at large."

Dr. Raymond's doctrine of sixty years ago is now generally accepted civic dogma. It has been reaffirmed by leaders of thought and of our industries, in natural, major, and minor key, in increasing volume, especially in the last decade. Every proper influence should be exerted upon our national officials, to the end that its crescendo may climax in some action at Washington. No problem of our complex national affairs—not farm relief nor prohibition—transcends in importance the necessity that Congress be brought to an increased realization that Industry in the United States has in very truth come of age and can be trusted to behave itself.

In every field of corporate business which is performing a national service, leaders with constructive purpose are with clear voice demanding Industry's release from its present limitations. Dr. Smith, in his address, quoted Messrs. Schwab, Hoover, and other industrial leaders. Reference has already been made in these columns to the fact that Mr. James H. McGraw, in a recent announcement, calls stirringly for more statemanship in business —for increased dedication to service. The thought is dominant in our existing industrial and civic life.

Dr. Smith is indeed fortunate in that he may speak in a dual rôle: as the director of the United States Geological Survey and as president of the A.I.M.E. His address deserves wide reading, and his appeal should have the support of all our citizens who possess the intelligence to realize the restrictions imposed on Industry by laws that owe their existence to the conviction that American business, corporately, is inherently dishonest.

"Interpretations" of the provisions of the Sherman Law and the Clayton Act that nullify their plain intent are repugnant to honesty and self-respect. They stink of hypocrisy. They are rooted in cowardice—in fear to face facts that are plain to all men who possess sufficient courage to accept the truth. The honest course is to revise or to repeal the laws themselves.

Labor Shortage Possible in Metal-Mining Districts

TIGHTNESS in the copper market in the last month or two, with indications of increased world consumption and a price approaching fifteen cents per pound, has naturally led producers to think of increasing production. For many years now, one of the reasons assigned for the comparatively low copper prices has been the unused capacity of producing plants, thus making a potential if not an actual overproduction. This potential capacity may not be as great as supposed, but it has been an actuality, for all that, and consumers have known that there was little likelihood of any important shortage of metal; therefore they have never shown any serious tendency to become panicky when a buying wave was on.

The copper production statistics for June already reflect the fact that most of the companies have made an effort to increase production to accord with what they think the demand is likely to be. At the steam-shovel mines, this has been easy; but in some of the "vein" camps a hindrance has arisen that perhaps has not been given sufficient attention; and that is the lack of an adequate labor supply. The season has without doubt been unfavorable to a sudden increase of operations, for in the summer-time many laborers find other more congenial work to do, but the indications are that miners will not be any too plentiful in the fall and winter either. It takes time to make a miner; it is not possible to get efficient work out of any able-bodied man that comes along and thinks he would like to try his hand at an underground job. Even if all the cotton-mill operatives that are striking in New Bedford for a living wage could be transported to the West where mine labor is required, no great immediate benefit would result to the mine operators so far as efficient mining is concerned. In years gone by, the supply of men has been augmented by immigration; but this source has been largely restricted. Introduction of labor-saving machinery and improved technique have gone far to remedy the decreased labor supply, but there is, of course, a limit to this solution of the problem.

Copper production can, in all probability, be expanded sufficiently to meet the demand, for no sudden jump in consumption is likely; but it must be remembered that lack of experienced workers is perhaps the most pressing problem that many of the producers have to face, and every effort should be made to train and retain men for underground and other skilled work.

Relative Merits of Flotation and Cyanidation

MUCH has been written about the relative merits of cyanidation and flotation, but the question has been obfuscated at times by an assumption of rivalry. As a matter of fact, however, each of the two processes has its own particular field of suitability for certain ores. Rarely does the analysis of favorable and unfavorable factors take into account the fact that cyanidation produces a refined metal; flotation, only a concentrated product. A concentrate must be transported to a smelter at high cost compared to bullion shipments and not all of the valuable metal content is paid for in the ordinary settlement made by the smelter.

In many instances the ore from the upper levels of a mine may be treated successfully and economically by cyanidation. At greater depths, however, base metals may occur; and the recovery of the precious metal becomes economically impracticable, by reason of an inability to adjust dissolution so that it is selective—abstracting the gold and leaving the base metal, which consumes a solvent the cost of which is out of proportion to the value of the product recovered.

Progress has been made in the treatment of mixed gold or silver ore containing minute amounts of soluble base metals. Cyanide used for dissolution purposes is not necessarily lost. Regeneration by a special recovery process, such as the one developed by the Merrill Company, is proving feasible in many instances.

At times, however, cyanidation must be abandoned in favor of a process that employs physical rather than chemical methods for the concentration of the wanted metals, making it possible to include those that are not economically recovered by a wet process. The need for such a change has been demonstrated, for example, at the Consolidated Cortez property—a silver producer—in Nevada; and Messrs. J. O. Greenan and E. M. Bagley have interpreted the situation there in recent years in an interesting and helpful manner. An article on this subject is scheduled to appear in the next issue.

The character of the ore altered radically as work progressed; soluble lead and copper increased in amount in the lower levels of the mine. Three factors prompted the change from cyanidation to flotation: the increasing cost of cyanide treatment, a decreasing recovery of silver, and the opportunity to augment income by taking advantage of smelter credits for the base metals in a flotation concentrate. The problem, therefore, was more one of economics than of metallurgy, and the factor of marketing expenses had an important bearing on the ultimate decision.

A feature of the remodeled plant is the use of the flotation cell developed by Mr. J. B. Parker, of Salt Lake City. As the authors conclude: "It may safely be said that flotation is responsible for the continuance of profitable operations at Cortez . . . The flotation plant paid for itself, in lowered milling costs and increased recovery, during its first thirty days of operation." Even so, not every one was united in recommending it.

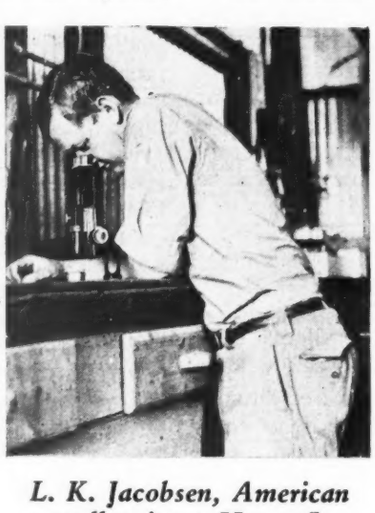
In this age of rapidly advancing technique too many examples cannot be quoted to demonstrate the value of an open mind in the making of a metallurgical decision. The abandonment of a process is not necessarily an indication that a mistake has been made. Usually it is an indication of a technical alertness that is essential to progress.

Developing The Mount Isa Mine

Initial Expenditure Is £1,000,000— Production Expected a Year Hence

By W. J. MORLEY
Special Correspondent, Chelmer, Australia

THE chief matter of interest in the last few months regarding the Mount Isa lead-zinc-silver mines, in Queensland, Australia, has been the visit of Leslie Urquhart to the field, and the resultant formation of a definite policy for the future development and exploitation of this highly promising mineral region. Mr. Urquhart, well known as occupying a high position in mining finance in London, went to Queensland as the chairman and leading spirit in the Russo-Asiatic Consolidated, Ltd., which has control of the enterprise of the Mount Isa Mines, Ltd. This latter company owns all the Mount Isa operative mines, consolidated as one great mining venture. Mr. Urquhart was accompanied by W. H. Corbould, a prominent mining engineer and metallurgist, who has been the prime mover in Mount Isa affairs since its discovery in 1923, and by Deane P. Mitchell, metallurgical and technical advisor of the Russo-Asiatic Corporation. Mr. Mitchell, who is also a director in this corporation, was Herbert Hoover's right-hand man when he was the active partner in the firm of Bewick, Moreing & Company, at a time when it had large interests in Australia, and he had a great deal to do with the early evolution of the South Blocks mine of the Zinc Corporation at Broken Hill, in New South Wales.



L. K. Jacobsen, American metallurgist at Mount Isa, examining ore from the Black Star lode

Mr. Urquhart, in Brisbane, said he and his co-directors were satisfied that the indications at Mount Isa point to a mine of great magnitude—possibly one of the largest lead, zinc, and silver mines of the world; but he also said that the average of the ore, taken in bulk, is of a comparatively low grade. Profitable operation of a mine of this class depends on cheap production, which in turn is dependent on the economic conditions obtaining in the country in which it is located. The object of the visit of Mr. Urquhart and his colleagues to Queensland was to investigate these conditions before coming to a decision respecting future operations.

The result of the visitors' investigations proved quite satisfactory. While at Mount Isa and at Townsville, interviews—or "yarns," as they were called—were had with representatives of the Australian Workers' Union, and a good understanding, from the point of view of both sides, is said to have been reached.

The Mount Isa mines are 500 miles by rail from Townsville, the nearest port, and ruling freightage rates were too high to admit of the profitable working of such a remote mining center. Fortunately, too, this matter was happily settled with the state government, which owns the railways. An arrangement was made for the charging of such reduced rates as will enable the Mount Isa company to exploit its mine. At the same time the concession to be made is no more than has for years been granted to the mine owners of Broken Hill.

When Mr. Corbould was negotiating with the Russo-Asiatic people in London he advised them that the development of the Mount Isa mines would necessitate the expenditure of £4,000,000 in the erection progressively of three treatment units. Of these the first should have a capacity of 2,000 tons of ore a day, and cost £1,000,000; the second would cost a like sum; and the third £2,000,000. Mr. Corbould says that for such an ultimate expenditure provision has already been made. For the present, however, it is intended to base the equipment of the field on a total production of 2,000,000 tons, and to fix the initial expenditure at £1,000,000. If possible, all the branches of ore treatment will be carried out in Queensland. The estimated yearly production of the mine is 58,000 tons of lead bullion and 100,000 tons of zinc concentrates. With the expenditure named, the Mount Isa company has undertaken, in the first place, to erect reduction works at Mount Isa capable of treating about 2,000 tons of ore per day and producing the quantity of lead bullion mentioned.

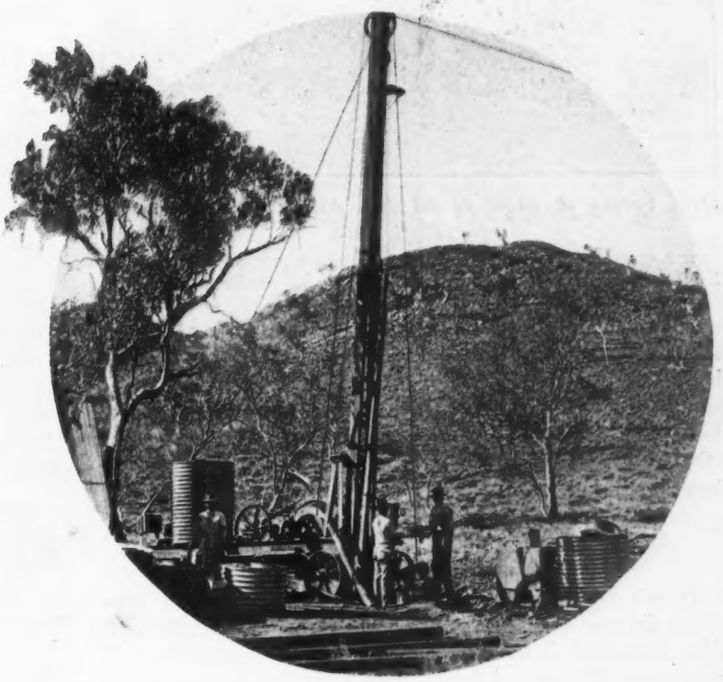
For the electrolytic treatment of the zinc concentrates it is hoped to establish a refinery on the North Queensland coast, and this will be done if the necessary hydroelectric power can be obtained from one or more of the

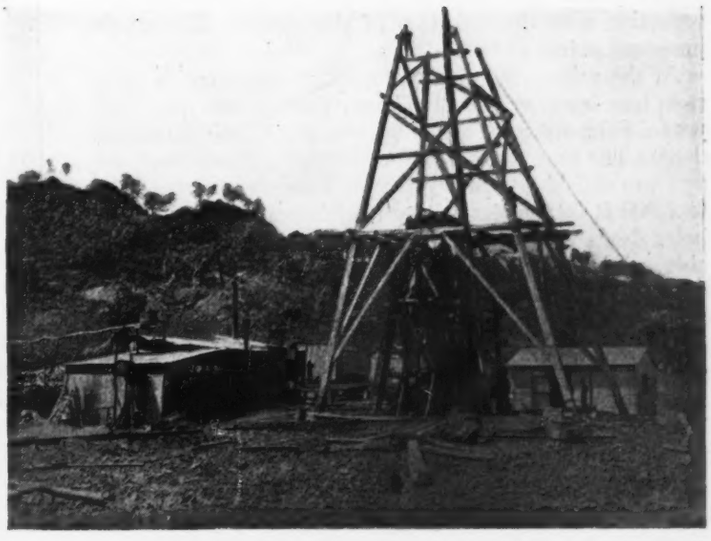
At the top—A panoramic view from the hill above the Black Star outcrop, showing the Davidson shaft and drills in the middle distance. The derrick of the deep-level vertical hole can be seen in the far middle distance

Right—Churn-drilling for water near the dam site at Rifle Creek

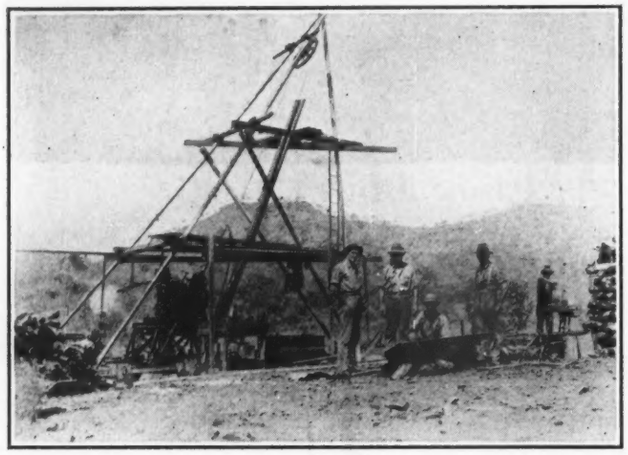
Bottom, left—Drill for vertical hole on deep levels, with derrick for 40-ft. pull

Bottom, right—Erecting the head-frame over the Lawlor shaft on the Rio Grande lode





northern rivers at a rate comparable with that charged for similar power supplied in Tasmania for the zinc production works at Risdon, in that state. There are two sources north of Townsville, either of which it is believed could be made to supply the requisite power, amounting to about 30,000 or 50,000 hp. These sources are the Tully Falls, on the Tully River, about 100 miles north of Townsville, and Barron Falls, further northward inland from Cairns. To investigate and report on



Drill boring at angle of 60 deg. with derrick arranged for 20-ft. pull

Left to right: J. Spence, mine foreman; G. Gray, superintendent; E. D. McDermott, engineer in charge of diamond drilling; H. Vail, drill foreman.

these waters the services of two experts from Tasmania have been secured by the Queensland government, and, if the result of their investigations warrants, the Mount Isa company will spend another sum of about £1,000,000 in the erection of the needed refinery at a convenient location on the coast.

First Unit of Reduction Plant to Have 2,000 Tons' Daily Capacity

Initial work at Mount Isa in connection with the program decided on is well under way. On the authority of Mr. Urquhart it has been stated that by about July of next year 500 tons of the first unit of the reduction plant of 2,000 tons' daily capacity will be in operation, and that six months later it is hoped to have the remainder of the unit in operation. In May an official of the Mount Isa company left Australia for London to settle matters in conection with the direction of the various units of the proposed plant.

At the mines, the diamond drilling campaign in progress has been vigorously prosecuted in the past half year. Five ordinary drills and one churn drill have been used. The new drills, sent out from England some time ago, are capable of penetrating to a depth of from 1,500 to 2,500 ft. Plans have been made to carry several boreholes down to at least 1,000 ft., if it be found that payable sulphides extend that far. Four of the drills are operating on the Black Star lode; and one is operating at Isa Deeps and one on the Ria Grande. Generally speaking, according to reports by government officials, the results of boring have so far confirmed previous estimates, and tend to show increasing reserves of ore. In the Lawlor shaft, in the sulphide zone, very good ore was found by the boreholes, averaging 17 per cent of lead, with 20 oz. of silver to the ton.

In addition to drilling, prospecting work is being carried on by underground mining, the principal centers of operation being on the Rio Grande lodes and at a number of prospecting shafts on the Black Star and Ibis leases. Driving on the Rio Grande lodes exposed satisfactory ore all along the levels. By crosscutting at the 260-ft. level in the Lawlor shaft, the main and No. 2 lodes have been connected. The main crosscut between these two exposed another lode carrying lead ore over a width of 14 ft. On the Black Star lease prospecting shafts have been taken to the required depths of 100 ft., and crosscuts put in from the bottoms to obtain information needed subsequent to open-cutting. A small compressor plant has been installed at the second Lawlor shaft, and with this steady progress is being made, the object being to open up additional levels in sulphide ore.

On the surface an experimental metallurgical testing plant has been installed, and additional headgear and other equipments for different shafts have been provided. The metallurgical plant, which has been installed and is being used under the supervision of Mr. L. K. Jacobsen, an American expert, foreshadows on a small scale what the larger permanent plant will be when installed.

Preliminary steps have been taken for the erection of workmen's cottages, which are to be of a design suitable for the climate and affording comfort and hygienic requirements for the future occupants.

New Dam Will Impound 600,000,000 Gallons

An important work in progress is the construction of a dam on Rifle Creek, a tributary of the Leichhardt River, about 20 miles above the mines and the Mount Isa Township. The beds of such Queensland western rivers as the Leichhardt, on the banks of which the mines are situated, are dry for the greater part of the year, when water can be obtained only from artesian wells or from "soaks," which also sometimes become dry in drought periods. To insure a regular supply of water for the

E. D. McDermott, engineer in charge of diamond drilling, looks up from examining a core

whole township, as well as for the mill and power house, a dam, 60 ft. high, is being thrown across a gorge on Rifle Creek to form a reservoir impounding over 600,000,000 gal. of water, which will find its way by gravitation to Mount Isa. Quite lately the churn drill used at the mines has been sent to the site of the dam, in the

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Two Sets of Brakes for the Mineral Industry

By Dr. GEORGE OTIS SMITH[1]
Director, United States Geological Survey

DR. GEORGE OTIS SMITH

IN DISCUSSING present-day troubles in the business and industrial world, we easily drop into the habit of clinical diagnosis and speak of social or economic conditions as pathologic. Talk of this kind, with its emphasis upon suspicious symptoms and abnormal tendencies, makes us all morbid. As an English essayist has put it, we may thus induce a melancholy temper that simply invites the ministrations of social and political quacks. It is far better—because nearer the truth—for us to recognize that our condition is in no sense deseased, that our body politic, social and economic, is suffering merely from growing pains, that nothing here in America is decadent—indeed, that any lapses from staid normality are traceable to the excesses of youth. Our chief trouble, then, is only that our industrial state is still young; it may be that we have been growing too fast.

IN FURNISHING the needed mineral raw materials to the great manufacturing industries of the United States there has never been any halt; rather has there been a general acceleration. No other phase of American activity can show equal advance. As the decades have passed, the winning of mineral wealth has progressed from the rôle of a stimulus for Western exploration to that of the foundation for nation-wide business.

In 1890 the Sherman Law was passed; since then the population of the United States has about doubled. Since then, too, the value of the annual product of the mines of this country has increased better than eightfold—from 650 millions to 5½ billions of dollars. Since then the four largest branches of the mineral industry, which supply the iron and copper, the bituminous coal and petroleum—the bone and sinew and the energy of all other American industries—have increased their annual output nearly tenfold as to value and sixfold as to quantity. Such a growth in the volume of mineral output must be taken as a true measure of the exceptional service rendered by the mines of the United States. Not only is this a much larger country than it was 38 years ago, when the Sherman Law was passed, but its growing mineral industry has met demands that have been out of all proportion to the growth of the population.

THIS fairly constant growth of the mineral industry would be a matter of national pride were it not that in recent years the industry seems to have grown too fast. To change the metaphor for a moment, the mineral industry—as well as our other industries—is over-engined, and those who are best informed by reason of their intimate connection with coal or copper, oil or steel, lead or zinc, or almost any other of the essential minerals, realize most keenly the ever-present hazard of the overdeveloped industry speeding up regardless of the curves or grades just around the corner. The American habit of "stepping on the gas" has brought the mineral industry close to the danger line

To regard ourselves as trustees, possessing the uncounted wealth of America only to be passed on to our successors in interest without unnecessary depletion, is adopting the Golden Rule in perpetuity. Stewardship of that type means the greatest good to the greatest number for the longest time, and that is practical conservation. Professor Ely, the economist, condensed his discussion of the principles of conservation into half a dozen words: "Civilization means regard for the future." Similarly, I once sought brevity by describing the great purpose of engineering in its many phases of constructive and conserving effort as "prosperity insurance." Conservation should be looked upon as furnishing an engineering problem, not a political slogan. Efficiency by wise use with avoidance of waste is the engineer's thought as he looks out over the wide spread of American resources, while the politically minded advocate of conservation thinks of avoidance of monopoly as requisite to a socially just distribution of that natural wealth. Political conservation sums up its message in "anti-monopoly"; practical conservation boils down its task to "anti-waste."

BUT the economic problem is far more extensive, . . . for similar conditions burden other branches of the mineral industry. The oil operator has his special hazards and handicaps, some nature-made, some man-made, but the same lag in the adaptation of the man-made laws governing business to widely changed conditions works to the disadvantage of the coal operator and the copper producer. In fact, practically everyone in the mineral industry—not only the stockholders who have invested in these creative enterprises but especially

[1]Excerpts of an address before the Section of Mineral Law, American Bar Association, July 24, 1928.

the workers, whose stake is even larger in continuous operation of the mines—everyone suffers from the present instability, which is due chiefly to the ever-present shadow of excess production.

The present situation is urgent as we look to the future. The mineral industry in general has outgrown its old garments and is in dire straits for new working clothes. And we must admit that in part the industry has itself to blame for the misfits. Progress, so called, may overstep reason. Most of our great industries are overgrown. Supply is ever ahead of demand, with little hope and less expectation of capacity orders. Under these chronic conditions neither 100 per cent efficiency nor a full measure of economy can be thought of. Meanwhile we are skimming the cream from many of our resources; of others we have already had to begin using the "skim milk."

AN EXAMPLE, and not an extreme one, of the constant tendency toward expansion in American industry is found in the country's steel plants. The steel ingot capacity is still increasing, even though there has been for years altogether too much of a gap between demand and capacity. Of course, there was an exceptional growth during the war period, amounting to 40 per cent, but a 20 per cent increase has since been added to that. Fortunately, fully half of this increase in capacity is credited to increased efficiency and improvements in old units, but all the unneeded new units brought into the economic picture continue to add their fixed charges to the cost of the product.

The new phrase in European business, "rationalization of production," means simply the most efficient use of all resources of a nation. Our transatlantic friends admit that it is the American plan which they have imported because they believe that it accounts for the amazing betterment in the American standards of living. But quantity production is wasteful unless it has a quantity market. Europe has laws that have enabled it to rationalize distribution better than America, even though it does not possess so good a home market. In America at present the rising costs of uneconomic distribution under forced draft of intensive advertising and high-pressure salesmanship may eat up the profits from low costs of production. America's leading iron master recently mentioned the cross-hauling of steel products as an item of preventable waste in distribution, recognizing the chief cause of this fundamental mistake in iron and steel economics to be the hunger for tonnage and the urge to operate at capacity.

INDUSTRY'S criticism of political and economic theories is not so much that they are out of style as that they are out of accord with the present magnitude of business and the trend of industry. Alterations and replacements are needed in the laws which affect these industries that are of country-wide scope and national consequence.

Not only has the United States doubled its population since the anti-trust law was passed, but it is a different country. Far less than a quarter of its inhabitants of today figured in the census of 1890; since then most of us now engaged in industry have attained our majority, received our training for work, and gained our experience in the life of work; and most of the great industrial units that today contribute so much to our prosperity have come into being. Yet the same prohibitions against collective or co-operative action in industries other than agriculture stand unamended on the statute books. Thirty-eight years is a long time in the growing period of American industry.

CERTAIN questions arise as we consider what is needed to meet present conditions: What is the teaching of experience? What principles tie the old order to the new? If control is indicated as essential to the general good of both industry and public, in what degree is it needed? What should be its methods and its purpose?

We may easily agree that the underlying purpose of exercising some control over a productive industry like mining is to promote efficiency, to prevent waste, and thus to lower costs. Unrestricted competition with its stimulative effect on production has been found too expensive a policy because in practice too commonly it is wasteful of material, of labor, and of capital. Both coal and oil, as they have been handled, light up a path that should not be traveled much longer.

To be effective in the mineral industry the control for the common good must be of such nature as to protect the resource against waste and to protect both the producer—a collective term for labor and capital—and the consumer against loss from prices that are too low or too high. Plainly control of production must start with the extractive branches of the mineral industry, where raw materials are won from the ground and where costs can be affected, and not with the market end, where control would be directed at prices only.

MARKET price is the acid test commonly applied by the consuming public, regardless of what is back of that price. Competition has too long been looked upon as the life of trade, for bitter experience has too often shown that competition may be the death of trade. The bankrupt route to low prices is not a safe highway. Stabilization of every industry, with prices properly related to costs, should appeal to consumers and producers alike. Control of costs from within an industry can accomplish more than control of prices from without. We are doing more than half the world's business in minerals, and I venture to assert that in much of this business we are underestimating depletion and counting too little on our future requirements. I have heard it remarked of several of the minerals in which America commands the world market, "We are selling out too cheap."

The essential nature and desirable extent of any proposed control of industry at once raise the question, control by whom? The ready-made answer that presents itself to many citizens who desire quick and sure relief is, "Let Washington do it." Granted that our desire is to attain that fine balance between individual responsibility and public regulation that expresses our American temper, we must yet recognize that times change and also the conditions of life.

AS LONG as industry and commerce continue to grow and expand and increase in complexity, so long must business and government live and work together. Perhaps a better illustration of the proper function of government than the traffic officer is the umpire. This umpire idea is, I believe, the view taken by the mining engineer who in recent years has directed the active co-operation of the Federal Department of Commerce with business. We see how apt is this simile. In the simple school-boy

game of ball we all played, we recognized no outside authority to call strikes, but a match game required some method of preventing premature termination of the contest, and professional baseball without an umpire to guide the game is beyond imagination. But the umpire doesn't play the game himself—he only enforces the rules that have been found necessary to insure fair competition, which means equal opportunity. A good umpire does not hamper or retard progress—rather, he facilitates and speeds up the great American game, even though his decisions may not please both sides and often least of all the consuming public on the stands. How close the likeness between umpire and public official, when the bleachers become vocal! At least, the figure of the umpire is helpful in considering ways and means of controlling business. The fewer the umpires that are needed and the less decisions that must be made the better, we will all agree.

THE analogy between the baseball diamond and the larger field of industry may be carried further by noting again that umpires are not players: Government regulation is not a first step toward government ownership or operation. I am confident that the trend is now in the opposite direction. Umpires do not upset the status quo; on the contrary they insure the continuance of the game under the best auspices.

The gratifying success which is now attending the operation of the public utilities and railroads under regulation presents strong testimony in favor of public control and against public operation. Today there are fewer electric power companies than there were fifteen years ago, yet they serve four times as many customers with six times as much current. These larger operating units are much more efficient and give better service at lower rates. Electricity is one of the few necessities of life the price of which has steadily shown a downward trend.

If further evidence of the contrast, as measured by results, between private industry and government business is needed, let us glance at the technical progress of an American mining company, one of the largest producers of copper. In 1905, with ore containing 40 lb. of metal to the ton, copper was produced at about 11½c. a pound; but last year, handling ore with only half that metal content, the company produced copper at 7½c. a pound. This lowering of cost by 4c., although the ore mined and smelted was leaner, was accomplished in spite of the 50 per cent increase in wages, 70 per cent increase in cost of supplies, and more than 600 per cent increase in taxes during the same period. Industry thus shows costs trending downward, and government shows taxes going up.

IN OUR generation we have witnessed rapidly mounting governmental expenditures—federal, state and local. The business of government has become the third largest business in the country, but the effort commonly exerted in increasing government efficiency does not seem to compare favorably with the progress of most branches of industry in reducing costs. A common-sense test of government entrance into this or that business project is whether it can be done better by the government than under private management, not whether it can be done as well. With the results of the railroad experiment during the war in mind, the burden of proof now surely rests on government operation. How many government enterprises would we advise our friends to invest in? And if a government project is not a good investment for a stockholder, is it a good investment for the taxpayer? The test of relative efficiency has largely removed the bugaboo of government ownership and operation, and no longer should that specter haunt the pathway of public regulation.

IT TAKES a lively sense of humor to watch the conflicting currents of petition and propaganda at Washington, the general tenor of which is to ask special privilege for this or that business interest, and at the same time hear these same petitioners declare—yes, even declaim—against government interference with business. Human nature would be less entertaining if it were more logical—but if these business men who come to Washington were more logical might they not be more helpful in defining what is the true relationship between government and business? Constructive statesmanship might well be contributed by the business interests which properly seek a better environment for the great industrial activities of today. The control of production in the public interest is too broad a problem to be solved by short-sighted and narrow-minded proposals. Not special privilege but general betterment should be the aim.

TO GIVE self-regulation of an industry the necessary scope, freedom of co-operative action is an essential condition. The Federal Oil Conservation Board recognized the existing uncertainty whether co-operation can be substituted for competition without running counter to federal and state laws, a doubt as to legal construction that had long served "as an actual or imagined or pretended barrier to co-operative action" in the oil industry. The Committee of Nine, on which your body was represented, in its report to the board specifically recommended legislation unequivocally declaring that co-operating agreements with the purpose of preventing overdevelopment of the petroleum industry and overproduction of petroleum are not in violation of the federal and state anti-trust laws. This principle of legalized co-operation in aid of needed self-control should be extended to all other branches of the mineral industry. When team play has been ruled out by the umpire, it is time to change the rules of the game.

The substitution of constructive co-operation within an industry for the competition that too often tears down the economic structure cannot, however, be expected from the governing people until the safety of the change is demonstrated. In its search for relief for the petroleum industry the Conservation Board plainly saw that the stumbling block lay in winning popular support for any legislation whose avowed purpose is to put brakes on the development of natural resources. Public opinion must be shown.

EQUALLY essential is that full publicity which is an indispensable condition of permissive agreements within an industry. Mr. Hughes stated the terms in appearing as the representative of the American Petroleum Institute: "Co-operation, of course, to be allowed only under conditions which would insure proper official scrutiny." Mr. Schwab, speaking in May last to the American Iron and Steel Institute as its president, said that if present laws force uneconomic conditions it is time to consider changes in the laws. With the steel industry earning little more than savings-bank interest on its 5 billion-dollar investment, he was prompted to recommend to

his fellow steel producers the making of comprehensive plans to achieve economies with government knowledge and possible supervision such "as will thoroughly protect the public interest." "Business in these days," said Mr. Schwab, "must be done in the full light of day." And others who lead in the thinking for modern industry might be quoted in direct opposition to the older idea, once vehemently asserted, that the books of corporate business are private and must not be opened to public view, even to governmental inspection. It cannot be too often repeated that the simple and sure way for business to win public confidence is to take the public into its confidence. Secrecy breeds suspicion. You will note that government appreciation of the critical situation that had developed, followed by popular understanding, permitted a degree of self-regulation in the oil industry that was hoped for but hardly expected when President Coolidge suggested that, "Government and business can well join forces to work out this problem of practical conservation."

ONE question remains: Is self-regulation enough; does it promise adequacy of control? The urge and driving force of private initiative must be preserved; can this motive power be kept under full control? Granted that there must be less restriction in the matter of guiding business, I suggest that there should be better equipment for governing its speed. The momentum of big business is a potential hazard to all within reach as well as a possible power for the general benefit.

So it is that I urge that brakes are needed by the mineral industry. The buggy period of small and slow-moving business is past; modern business requires modern brakes of the four-wheel type, ready for quick and effective application. I need not remind those who drive or even ride in these speed-mad days that it is the full equipment of powerful brakes that alone permits us to travel in high. Brakes do not impede progress: they speed it up.

As a matter of safety, a double set of brakes is now regarded as essential and indeed is generally required by law—brakes of two kinds, which can be applied independently. In terms of industrial control, we may look upon one set of brakes as representing self-regulation and the other as representing government restriction. However, it is more descriptive to refer to the one as the service brake, to be used in the ordinary running of affairs; the other is the emergency brake, a stand-by control, the less used the better, but a control that many leaders in industry acknowledge must be available as an ever-ready safeguard in heavy traffic.

THE power to slow down industry is a safety measure urgently needed at this time of high-speed development and mass production—needed in both the industry's own interest and the public interest. Rarely indeed will industry need to be brought to a full stop, and rarely should the emergency or government brake be used. Every automobile driver knows the feeling of his own awkwardness and inefficiency when through failure of the service brake to function he has to rely upon the emergency brake. Self-regulation, then, to the fullest extent possible, but a supplementary public control for emergency—this is the set of brakes that I am convinced is needed by the mineral industry. It is a high-powered modern industry that now looks to the lawyers for skilled help in designing and constructing the needed 1928-model brakes to replace the obsolete pattern of 1890.

Some of the New Uses of Cadmium

IN SPITE of the relatively high price of cadmium, and the fact that the world production is only about 500,000 lb. a year, the metal is beginning to find a number of important applications, says the *Industrial Bulletin* of Arthur D. Little, Inc. It has recently been applied to the rust-proofing of locks, hardware, automobile parts, and wire products by a process which involves electroplating the cadmium thereon, and subsequently heating the plated articles for several hours, whereby the cadmium coating is alloyed with the metal of the plated article. A small proportion of cadmium is often alloyed with silver to make the latter more resistant to tarnish.

An especially promising application of cadmium appears to be in its addition to copper intended for wire-drawing. These alloys have a higher tensile strength and annealing temperature and greater resistance to abrasion than hard-drawn copper, and as only a small proportion of cadmium confers these benefits, its addition does not seriously reduce the electric conductivity of the wire.

Cadmium is also finding limited use in jewelry, as it gives green alloys with gold, and it is employed to some extent in fusible alloys. Its addition to aluminum is advantageous where the aluminum is to be used in the manufacture of aluminum powder. The addition of cadmium in this instance improves the color and luster of the powder and makes it more resistant to atmospheric corrosion when used in paints or lacquers.

One of the latest uses reported for metallic cadmium is in the manufacture of tungsten electric light filaments. An alloy of 42 per cent cadmium, 53 per cent mercury, and 5 per cent bismuth is impregnated with tungsten powder. The mixture is made into wire by the extrusion process, and after passing through a die, is heated to drive off the alloy, and finished by heating in a vacuum to consolidate the tungsten.

Developing the Mount Isa Mine

(Continued from Page 126)

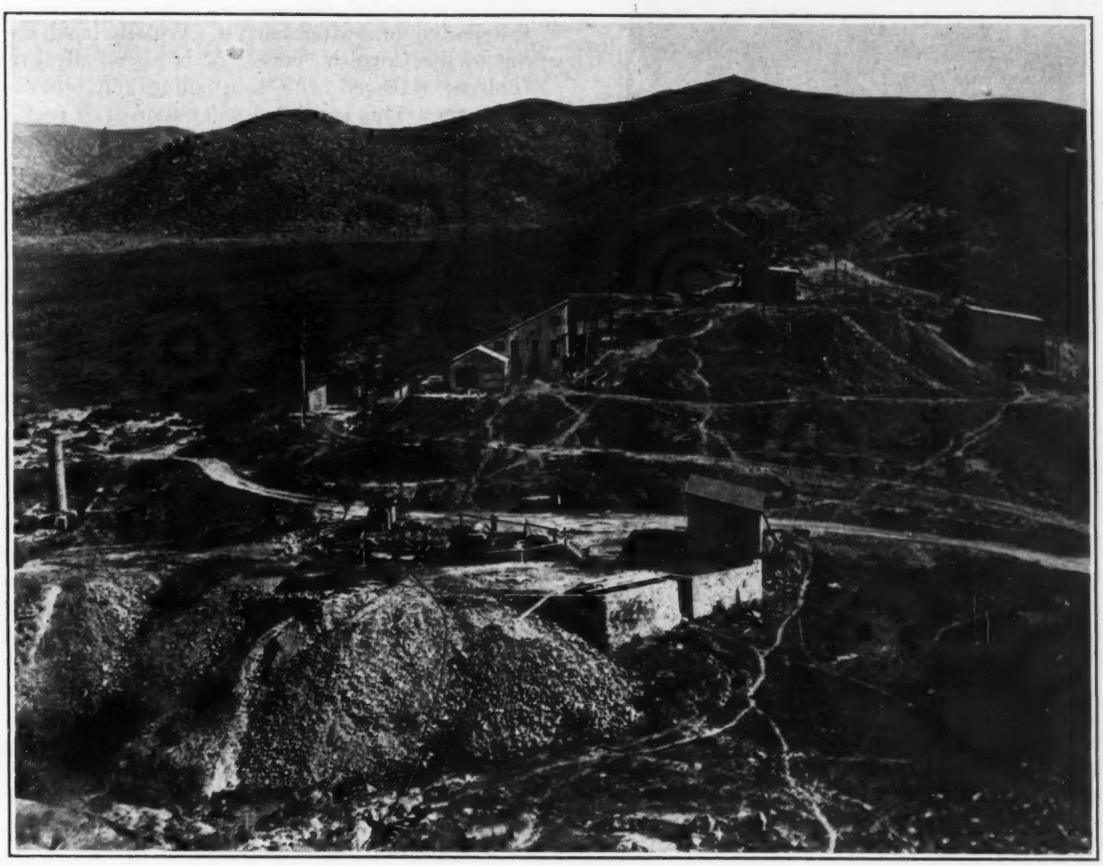
endeavor to find water for use in its construction. The dam is expected to be finished in time for the next wet season, at the end of the year.

The railway being constructed from Duchess to the mining field, a distance of 54 miles, is expected to reach Rifle Creek by October next, and will greatly facilitate the work of dam building.

Some comparisons have been made between Mount Isa and Broken Hill. In this connection it is of interest to point out that after 40 years' operations Broken Hill companies are treating about 2,500 tons of ore a day, and that, too, of rich ore, whereas the Mount Isa company purposes to start off as a beginning with an output of 2,000 tons of ore of low grade. The sulphide ore at the Barrier contains from 12 to 15 per cent of lead, and 9 to 12 per cent of zinc, as well as 3 to 7 oz. of silver per ton. The ore reserves at Broken Hill are estimated at 15,000,000 tons to a depth of about 1,400 ft. At Mount Isa diamond drilling had demonstrated some months ago the existence of orebodies to a depth of from 500 to 600 ft. and the indications are that some of the sulphides will show between 3,000,000 and 4,000,000 tons for each 100 ft. of depth. A conservative estimate of the Mount Isa ore, made by the Queensland chief government geologist, is 20,000,000 tons.

New Attempt to Develop *Temescal Tin Deposit,* in Southern California

By H. E. West
Mining Engineer, Santa Barbara, Calif.



The Temescal mine

In the foreground is the dump of the vertical shaft; up the hill at the right that of the inclined shaft. At the left is the experimental mill, and at the extreme left the stack of the old smelter.

TIN has been produced from only three localities in the United States. One is near Harney Peak, in the Black Hills of South Dakota; one in Southern California, east of Corona; and a small amount was recovered from a deposit of cassiterite from Irish Creek, Va., and was smelted in blacksmith forges prior to 1893. The American Tin Corporation is at present engaged in an attempt to develop sufficient ore in the Temescal deposit, as the California property is known, to warrant the equipment of the mine for production. It is credited with having produced 240 tons of black tin in 1892, since which time it has been idle.

Granite is the prevailing rock. Formerly slate covered the entire area, as shown some six miles south, on the Santa Ana range, westward and northward across the Santa Ana valley. Erosion has exposed the granite. To the westward are porphyritic rocks; there are no slates in proximity. To the south, less than halfway to Elsinore, are slates, fireclays, and lignite deposits.

The Cojalco hill, a prominent landmark, composed entirely of granitic lode material, occupies a central position east and west. The Cojalco lode alone was developed and found productive. Luck rather than acute perception was responsible for the blocking out by two shafts, 275 ft. apart, and a level 65 ft. below the adit, of sufficient ore to keep the mill working for two years, with the production of a fair tonnage of pig tin. Tourmaline is the characteristic and prevalent mineral of the

tin lodes. Fluorspar, barytes, iron pyrite (mundic) and mispickle—or arsenious pyrite—are either lacking or present in small quantity.

Kent says: "The outer portions of granite masses are

Old stope on No. 1 vein. Pillar contains 5 per cent ore

often subjected to the action of escaping vapors, containing boracic and hydrofluoric acid (fumarole action). They develop tourmaline in quantity, and often fluorite, and, in rare instances, cassiterite." The formation of these lodes has been suggested as follows:

1. Fractures of granite.
2. Filling with tourmaline, with replacement of the feldspar.
3. Refracturing.
4. Deposition of cassiterite from cooling vapor.

No reliable data of the tonnage mined or grade of ore are available. However, a study of old records leads me to make the following estimate: Mined and milled, tons, 10,000; content, black tin, per cent, 3; content, total, tons, 300; dressing loss, tons, 60; recovery, tons, 240.

The concentrate was reduced in a furnace, and allowing for loss in slag, hardhead, fumes, and smoke, approximate 100 tons of pig tin, say 98 per cent pure, might have been made.

The American Tin Corporation began active mining only this year. Prior to that time about a year had been expended in perfecting surface arrangements and securing title. The company became interested in the deposit through the reports of former workers, and prospects of the property seemingly satisfied New York capitalists. Experienced men were placed in charge, and the mine was unwatered and kept clear of water by an electric pump. Old levels were cleared up and the old stopes opened. The Vertical or Robinson shaft had caved to the adit. The inclined or Williams shaft was in fair condition. Timbers were straightened and repaired and the deepening of the shaft was resumed. The mine was surveyed, and a plan of development laid out.

At the time of my visit to the property on May 5, 1928, the inclined shaft had reached a depth of 40 ft. below the No. 5 level, or 440 ft. below collar. The bottom showed 4 ft. of good-looking lode, that carried some tin. Water was making in fair quantity. No. 5 level was being driven both ways showing 3 ft. wide in both headings, a fair lode, carrying tin, but not visibly.

In the Cojalco vein cassiterite occurs usually in coarse crystals resembling garnet, or in finer crystals of lighter color, usually in bunches, associated with iron oxide, in tourmaline. A "speckled" black-and-white rock forms the remainder of the lode, in which tin is more sparsely distributed, and often barren. Usually hard, corresponding to the Cornish "capel," it is essentially granite with feldspar replaced with tourmaline and other secondary products. This capel is harder than wall rock, no doubt accounting for the levels being driven in the footwall. The footwall is ragged. The hanging wall is well defined, usually with a clay gouge, and slabby.

A factor of economy today is electrical power. A substation is located at the mine and a power line, 3 miles long, connects with the main line of the Southern Sierras Power Company.

Outside the Cojalco lode numerous others are exposed in the concession of this company. In the old days El Rancho el Sobrante de San Jacinto consisted of 40,000 acres, all available for exploration. A system of clearing the ground and exposing the lodes to show clearly their width, strike, and general characteristics aids in planning prospecting. All veins are numbered. Mexicans are busy at surface work and in sinking shafts, and some developments give promise. Though these prospects may disclose bunches of ore, as did the Cojalco, it is evident that development at lower depth in the Cojalco deposit must be remunerative or the others will not amount to much.

Geophysical prospecting for local "conductors" seems to offer little assistance. The "conductors" are evident, but oreshoots are not revealed by such prospecting. Tin is where you find it. With diamond drills good "shooting" would be required to strike erratic oreshoots, though they undoubtedly are useful to determine geological and general lode conditions at depth.

A small test mill is situated where a light stamp mill stood formerly. A Hardinge mill does the crushing; an impact screen sends its products to two small Wilfley tables, one treating the coarse and the other the fine material. Some test runs have an encouraging edge of tin; and smelting of the concentrate is being done experimentally.

As to the general joy of living for the mining engineer, there are two places that stand out in my estimation. One is at Catalina, at the Wrigley mine. The other at Temescal, with a home at Riverside, or at the mine. Most camps are in some God-forsaken frontier of civilization. Life is pleasant in Southern California. Only one of the former buildings remains. This is now the assay office, where Ralph H. Shaw, metallurgist, has made some thousands of assays. Hubert C. Field is in charge of surface developments and stripping. Jay Tuttle, Jr., is general superintendent. Each has graduated from a school of mines and has had experience in other fields.

Impressions of the Ray Copper Concentrator

Simplification and High Efficiency Feature Remodeled Flow Sheet—Operations at the Christmas Mine

Part XII: Revisiting Arizona Mining Camps

By E. H. Robie
Associate Editor

FROM GLOBE I set out for Hayden in a somewhat dilapidated open Ford car in which I was the only passenger; on its return trip the same day my seat was occupied by a bale of hay. This stage runs daily, but receives so limited custom that the fare is all out of proportion to the distance—$5.50 for the 44-mile trip requiring about two hours. Leaving Globe, business promised to be excellent, with several prospective passengers on the street corners, but the stage driver told me that these were dead beats; apparently great discernment is necessary in order to know who is likely to prove a paying passenger and who is not. The Indians, who abound in this district, are sometimes carried free, but the white man in straitened circumstances must usually walk unless he is fortunate enough to find a passing car whose driver is willing to give him a lift.

A good road has now been built from Globe to Hayden; several years ago, when I first made this trip over the Mescal and Dripping Spring Mountains, a part of the route followed dry washes in which there was no roadbed at all. A long ascent is made to the Mescal range, affording a magnificent view of the surrounding desert. In fact, I am told that a greater extent of country can be observed from a vantage point near this road than anywhere else in the United States, with perhaps one exception. It is typical Arizona scenery and unlike anything that one may see in the East, where the countryside may be just as attractive, but it is roadside scenery; whereas in the West the vistas extend for miles.

At Christmas, near the entrance to the box canyon of the Gila River, which prevents the railroad from making a highly desirable connection at San Carlos, I alighted and walked up the road (which has a 20 per cent grade in places) in the hot March sun to the Christmas mine. This is an old and well-known mine. The claims covering the mining property were originally located by Dr. Douglas in 1884. A survey, subsequently made, showed that the claims were in the San Carlos Indian Reservation, though before this fact was known considerable money had been expended on the property. Efforts were then made to have a large area of ground, in which the claims were included, segregated from the reservation, and an act of Congress was finally passed bringing this about. Some one on the ground who had been watching the proceedings received a wire from Washington that the bill had been signed, and relocated the property the next morning, which happened to be Christmas Day. Hence the name.

The property is now being operated by those formerly associated with the Iron Cap Copper Company, near Globe, which was forced to close down its mine and mill recently, owing to lack of ore. The Christmas mine was then selected as a favorable site for a continuance of operations, which are being conducted under the general managership of F. A. Woodward, of Globe. His son, H. W., is local superintendent.

After partaking of the hospitality of the mine boarding house I donned some overalls that were designed for Mr. Woodward rather than myself and explored the workings, which total some six or seven miles in extent. The ore occurs as a replacement of copper sulphides in limestone, along an intrusive contact. It is not high-grade, carrying about 3 per cent copper as mined; and, as it must be shipped about 8 miles to the Hayden smelter, the opportunities for profit with small-scale operation are not large. About 100 tons per day is now being produced, a favorable smelting rate being secured because of the limy nature of the ore. Plans are now being perfected to erect a concentrating plant of sufficient capacity to handle a production of 500 to 600 tons per day. A basic ore of this character would also find a ready market in Miami, but that smelting center is ten times as far away by rail as by motor road; so shipment is too costly. An aërial tram carries the ore down the hill to the railway terminus, whence it is shipped to Hayden.

Hayden boasts of two plants of major importance: the concentrator of the Ray branch of the Nevada Consolidated Copper Company and the smelter of the American Smelting & Refining Company.

The concentrator, of which W. I. Garms is superin-

tendent, today bears little resemblance to the plant of a few years ago, when it afforded one of the last visible examples in this country of grinding by Chilean mills and the use of extensive hydraulic classification. Seven of the original eight sections have been entirely remodeled. Each new section has an operating capacity within the range of 1,000 and 1,750 dry tons per day, depending upon the screens used in the fine-crushing roll department. At present the sections are being operated at 1,250 tons per day. The flow sheet is exceedingly simple, and the arrangement of the equipment is such that a visitor hardly requires the services of the usual guide.

Tabling Abandoned in New Flow Sheet

The ore is received at the concentrator already crushed through 1 in., and the first operation is further reduction to all-through 10 mesh by rolls in closed circuit with impact screens. Table treatment of the roll product has recently been abandoned, the pulp going direct to bowl classifiers, in open circuit, for removal of the primary slime, which then goes direct to the flotation department. The bowl classifier oversize is then ground in 7x10-ft. cylindrical ball mills in closed circuit with drag classifiers. The overflow of these classifiers joins with the overflow from the bowl classifiers and thence goes to the roughing flotation machines. Concentrate from the roughers goes to cleaners, and the tailing to waste. The cleaner concentrate goes to re-cleaners, and the tailing to the head of the rougher. Re-cleaner concentrate is a final product, and the tailing goes to the cleaners. The flotation concentrate is settled in a cone, the overflow from which is filtered, and the spigot product from which is merely settled in bins to remove water, excavated, and shipped. That flow sheet does not require a diagram to make it clear; gone is all of the elaborate hydraulic classification, dewatering, and thickening apparatus that complicated the old plant; gone is half of the flotation equipment that was being used no longer than two years ago. As it seemed to me that particularly fine work is being done here, let us take a walk around the plant with one of the mill men and see what is going on.

As we walk up to the head of the mill, he will emphasize that the outstanding thing accomplished has been a simplification of the flow sheet and the maintenance of a proper balance between the different stages of crushing and grinding. Coarse crushing, fine crushing, and fine grinding are entirely distinct. Especial attention is given to the proper conditioning of the pulp, so that the old-time flotation machines now have double their former capacity. The small size of the operating and repair crews necessary to run the plant is quite noticeable.

Representative assays and mill statistics are given in the accompanying table. The ore, it will be noted, contains about 1.4 per cent of copper, which is largely in the form of chalcocite. This is accompanied by pyrite, which the chalcocite has in part replaced, as is evident from the fact that some particles have a core of pyrite, surrounded by chalcocite. This mineralogical condition necessitates very fine grinding.

General Milling Statistics

Average ore treated per day, dry tons	8,000
Copper in mill feed, per cent	1.42
Copper in tailing, per cent	0.16
Flotation concentrate, per cent copper	20.14
Flotation concentrate, per cent iron	28.79
Flotation concentrate, per cent "insoluble"	10.84
Recovery, per cent	89.44
Pounds of crude lime per ton ore milled	5.25
Pounds of free CaO per dry ton flotation feed	0.7
Pounds of roll steel per dry ton (includes scrap)	0.138
Pounds of semi-steel balls per ton	1.04
Pounds of steel liner consumption per ton	0.05
Pounds of Raconite per ton ore milled	0.06
Pounds of pine oil per ton ore milled	0.12
Average life of roll shells, days	58
Average life ball-mill liners (est. days)	800

Apron feeders, belt conveyors, and bucket elevators are used for transporting the ore from the bins to the first set of screens. Each mill section has two sets of 42x16-in. Garfield rolls in closed circuit with eight Chino type impact screens, all operating wet. Inasmuch as the coarse crushing is all done at the mine and the feed to the rolls is all through 1 in., it was thought that possibly ball mills would be superior to rolls, but experiments just completed at the time of my visit indicated that this was not true; that the crushing above 10 mesh could be performed better by rolls than by ball mills, and that for the extremely fine grinding necessary for flotation the long cylindrical ball mills were advisable. It is a maxim here that no fine crushing should be done in the coarse-crushing department and no fine grinding in the fine-crushing department.

Until recently the roll product was all-through 14 mesh, but the inclined impact screens are now covered with 7-mesh screen cloth, of 0.054-in. wire, for the screening of the roll product. This throws a little more work on the ball mills, but there is a much better balance between the two departments.

Inasmuch as about half of the roll product is minus 100 mesh—largely what might be termed primary slime—it is obviously advisable to short-circuit it directly to the flotation cells. This is accomplished by treatment in an 18-ft. Dorr bowl classifier, which is considered a very important part of the flow sheet.

Where a considerable percentage of material sufficiently fine for flotation can be extracted from a roll product, it is increasingly becoming the practice, in other plants also, to submit the pulp to bowl classification. This apparatus is particularly well suited to the separation of coarse sand and primary slime. I have observed, however, that the bowl type is not so often used as the ordinary drag type for the secondary classifiers in closed circuit with ball mills. No advantage is there gained, and the operating upkeep of the bowl is eliminated by the use of the simpler machine.

The coarse material from each of the bowl classifiers, the rake discharge, is split evenly between the two 7x10-ft. ball mills. Part—about 20 per cent—of the bowl overflow is used, in addition to the necessary water to effect proper classification, in the drag classifiers in closed circuit with the ball mills. The ball mills operate at 16½ r.p.m. Latest installations are direct-driven from 150-hp. Allis-Chalmers synchronous motors through a magnetic clutch and herringbone gears. The horsepower required is about the same as for the older type of drive (about 130 hp.), but there is considerable improvement in smoothness and quietness of running. Gears and pinions cannot be so readily interchanged, but this is not so important nowadays when gears are made so long-lived.

The ball-mill liners are home-made from scrap material. Formerly rails were cut up in short lengths and set on end, in concrete, in the ball mill shells. Recently, however, used roll shells have been employed. These are cut up with oxy-acetylene torches, along lines parallel to the axis of the shell, into rectangular pieces, which are then embedded in concrete in the periphery of the mill, similar to the manner in which the pieces of rail were embedded. This makes a most satisfactory liner, lasting more than two years. The balls used are locally

made, of cast steel, and are 2 in. in diameter. A 3-in. ball was formerly used, but, as I mentioned in an earlier article, the smaller balls are becoming increasingly popular. As an indication of the improvement made in crushing and grinding by instituting the practices that I have mentioned, and more particularly the balancing of the work done in the different stages of crushing and grinding, costs have been reduced 5c. per ton, without introducing any new crushing equipment.

The ball-mill discharge is elevated, in single-bucket elevators, to the 8x28-ft. Dorr drag classifiers operating at 16½ strokes per minute. The circulating sand product is 80 per cent solids and the overflow product 32 per cent solids. Grinding is carried about as fine as at any plant in the country with which I am familiar—5 per cent on 100 mesh and 80 per cent through 200 mesh. The "mineral" in the pulp to flotation is ground finer than the gangue particles, because of the concentration and repeated grinding effected in the ball-mill circuit by proper control of the classification. This is made necessary by the intimate mixture of the chalcocite and pyrite, if pyrite is to be dropped to any extent in flotation.

The flotation department for the entire plant is in two sections, each of which is supplied with pulp by a 26-in. pipe line leading to the department from the combined ball-mill classifier overflows. Such a pipe line has advantages over open launders. The flotation sections have one unit for each mill unit. Each unit consists of one duplex row containing twelve rougher cells and two primary cleaner cells, and a single re-cleaner cell. These cells are much like the well-known Inspiration type, being 14.2 ft. long inside, 2.4 ft. wide, and 30 in. deep, with a slope to the bottom of ½ in. per foot. The air mats in the bottoms have cast-iron grates running lengthwise of the cells which protect and support the canvas fabric. The total effective air area of one cell is 26.2 sq.ft.

With so much heard of the newer type of flotation equipment, I was mildly surprised to see no change in this plant. I was assured, however, that this type of cell had given excellent results here so far as upkeep costs were concerned, and that from a metallurgical standpoint, also, the cells in use were as good as if not better than any other cell tested to date. The inclination here is to place a great deal more importance in a proper preparation of the pulp than in the type of flotation equipment used. Experiments have been conducted with the new free-air type of cell, but the lower power cost was offset by a higher tailing loss. The Inspiration type of cells used were being supplied with 4¾-lb. air at the time that I was there, according to the recording pressure gages, but this was said to be abnormally high because of a test run, 4½ lb. being the usual standard.

The last time I saw the Ray mill, porous concrete bottoms were being used in the cells instead of canvas. There seems to have been no particular objection to the concrete mats; they worked well and were durable, but were more trouble to make and apparently have been superseded because no one was especially interested in taking up the cudgel in their behalf. The canvas mats last sixty to seventy days. No acid wash is necessary to keep them from becoming incrusted, as they receive a continuous tamping by hand labor.

The rougher cells are placed below the cleaners, necessitating pumping the rougher concentrate up to the cleaners, but the tonnage handled by this method is small, and the arrangement is more economical. Wilfley pumps are used here as in many other places.

As shown in the table on page 134, lime, Raconite, and pine oil are the reagents used. A part of the lime is fed as milk of lime into the roll circuit; the rest at the inlet to the tube mills. Addition of the lime to the roll circuit results in neutralizing the bowl classifier overflow, which goes direct to flotation. The mill water uses up about 2 lb. of lime per ton of ore; in all, about 5 lb. is added. A portion of the pine oil is added to the ball mills to make a steady froth in the first flotation cells; the rest is added at the head of the cells. The Raconite used is a home-made product made according to a patent granted to J. L. Stevens in 1926—No. 1,594,858. It is called "Raconite," after the Ray Consolidated Copper Company, and is made from caustic soda, carbon bisulphide, and an alcohol. The Raconite, in amount equal to 0.06 to 0.07 lb. per ton of flotation feed, has been used for the last two years; it is added to the ball-mill classifier overflows. Yarmor brand of pine oil is employed.

Troubles Caused by High-Grade Concentrate

Heretofore, on a grade of ore corresponding very closely to that now being milled, the flotation concentrate produced was about 12 per cent copper, 29 per cent iron, and 18 per cent "insoluble." The present grade of concentrate (see table) has been brought about largely through proper control of the point of addition and quantity of the lime, Raconite, and pine oil used in the circuit. Practically all of the free pyrite liberated in the grinding is dropped. The high iron content of the final concentrate is caused by the intimate association of the chalcocite and the remaining pyrite.

When the percentage of sulphides in the concentrate was so greatly increased, trouble immediately arose with the succeeding equipment. The launders became clogged, and the thickeners and filters would not operate satisfactorily, on account of the rapidly settling concentrate. It was therefore decided that if the concentrate was so anxious to settle, it should be given the fullest opportunity to do so; in fact, should be encouraged—thus making a virtue out of a vice. Accordingly, all the flotation concentrate now goes to a 9½-ft. 60-deg. cone, only the overflow from which is filtered. Thus, of the one 40-ft. thickener, two 75-ft. thickeners, and four filters making up the filter plant, only the 40-ft. thickener and one filter are required to handle the cone overflow.

The coarser part of the flotation concentrate, settled out in the cone, goes to the old concrete bins formerly used for the dewatering of table concentrate. These bins overflow as they are being filled, the overflow going to the filter plant along with the overflow from the cone. After the bins are filled they are allowed to settle for nine days, after which time the average moisture content has been reduced to about 10 per cent. The bins are then excavated with a four-ton Morgan gantry crane equipped with a clamshell bucket. The entire cost is as low as or lower than dewatering and filtering, under favorable conditions.

Labor and power economies effected at the plant are

Mill Power Consumption

	Kilowatt-Hours per Ton of Ore Milled
Coarse crushing, at the mine	0.45
Fine crushing, roll circuit	3.25
Fine grinding, ball-mill circuit	4.03
Flotation concentration	1.87
Dewatering and filtering	0.25
Primary water	0.90
Recovered water	0.27
Industrial buildings and incidental equipment	0.11
Total	11.13

of interest as well as the strictly metallurgical improvements. Most of the few men observed about the plant, including the repair men, seemed to have nothing to do except to keep their eyes open. This condition is quite different from that of six years ago, when approximately the same tonnage was being concentrated. The power consumption is one of the lowest in the country, being approximately as shown in the preceding table. A range of 10.80 to 11.50 kw.-hr. per ton represents average monthly practice.

All concentrates produced by the plant are loaded into railway cars and transported to the adjoining smelter of the American Smelting & Refining Company, which will be discussed in my next article. The tailings flow by gravity to a 1,000-acre disposal area on the bank of the Gila River.

Speaking of Arizona rivers, Hayden is located just below the junction of the Gila and San Pedro rivers, which are considered of importance as to size. However, I did not see very much water. The natives told me that the water was flowing in underground channels to keep out of the hot sun. The postmaster at an Arizona town situated upon a river that had temporarily gone dry once received a questionnaire from the United States Fish Commission at Washington, for full particulars regarding the number and kind of fish that inhabited the near-by waters, and such other piscatorial data as were available. The reply, so the story goes, was somewhat as follows: "The last fish seen hereabouts was going up the river bed with an empty canteen under his left fin, looking for a drink." One of the boys told me that if this fish comes to the Gila River next year, he can discard his canteen, as the completion of the Coolidge Dam on the river about 20 miles above Hayden will insure year-round drinks (of water) for the fish, the farms, and the visitors.

U. S. Indian Service Operates an Unusual Quarry

ON THE San Carlos Indian Reservation, three miles north of Rice, Ariz., an unusual quarry is operated by the U. S. Indian Service. The deposit is a white, weathered rhyolite, 45 in. thick, with a cover varying from 2 to 20 ft. It extends over an area of more than a square mile, and is underlain with clay. As quarried, the rock weighs 76 lb. a cubic foot, but air drying in the sun reduces this weight to 55 lb. a cubic foot.

Blocks measuring 12x12x36 in. are wedged out of the quarry face and dressed by a crew of ten Indians, one man quarrying ten blocks, or dressing seven, a day. Owing to its low compressive strength and its porosity, use of the material for building purposes is limited to one-story structures in a warm, dry climate, such as that of southern Arizona.

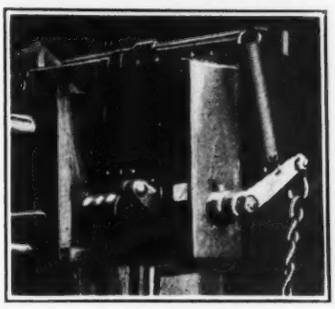
Many of the buildings on the reservation, including the agency office buildings, dormitories, school buildings, dwellings, and a church, have been constructed with blocks from the quarry. At Fort Thomas, 45 miles southwest of the reservation, is a high school built of the material. Besides being easily dressed and transported, the rock is an excellent insulator, and hence buildings constructed with it in the district are pleasantly cool during hot weather. The material may also be carved, and in the Lutheran church on the reservation is an ornate altar fashioned by the rector.

To the left is shown the face of the quarry; below may be seen the Indians dressing the blocks; and in the corner is a church and dwelling built of the product.

A Practical Safety Signaling System for Mine Hoisting

By H. D. KEISER
Assistant Editor

FATAL SHAFT accidents continue to occur, owing to inherent defects in the conventional systems employed for signaling the hoist engineer to move or stop the cage. For instance, the empty cage is at a station, a man is pushing a loaded car toward the cage, a signal given inadvertently from a lower station results in the engineer moving the cage away. The man pushes the car into the open shaft, instinctively keeping a grip on the car, and is pulled into the shaft with it to his death. The remedy, in this circumstance, is to make it impossible to give a signal from any station unless the cage is there. Another example: A cage loaded with men is going up; a piece of lagging, or stray timber, falls on the cage; a signal to the engineer would stop the cage almost instantly, but no signal can be given. The timber grinds and finally jams, so that it enters the cage, killing or maiming the men. The remedy, in this instance, is to provide signal ropes in the cage that can be operated immediately in an emergency.



Cage in Daly West shaft, showing signal box with cover removed.

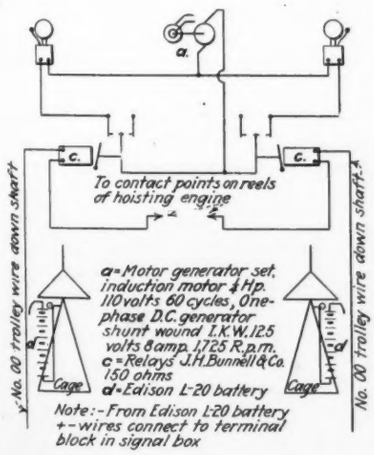

a
c.
c.
To contact points on reels of hoisting engine
No. 00 trolley wire down shaft
No. 00 trolley wire down shaft
a=Motor generator set, induction motor ¼ Hp. 110 volts 60 cycles, One-phase D.C. generator shunt wound 1 K.W. 125 volts 8 amp. 1,725 R.p.m.
c=Relays J.H. Bunnell & Co. 150 ohms
d=Edison L-20 battery
Cage
Cage
Note:-From Edison L-20 battery +-wires connect to terminal block in signal box

Fig. 1—Engine room wiring chart for hoist signal system.

Records of very many similar accidents in various mining districts convinced the officials of the Park Utah Consolidated Mines Company that a proper signaling system to make such accidents impossible must be installed in place of the conventional station pull switches. It was soon realized that a signaling system operated by pull ropes (or chains) on the cages could be equally accessible to men traveling on the cage and to a station tender dispatching the cage from a station. If, furthermore, the source of signaling current could be a battery on the cage, no signals could arrive at the engineer's platform except those made by closing the contact on the cage. The further addition of a noise feature to the cage contact mechanism would insure that every man on or near the cage would know when a signal was given. Such a system was perfected, and has been in operation in its perfected form for about five years at the company's main shafts in the Park City mining district of Utah.

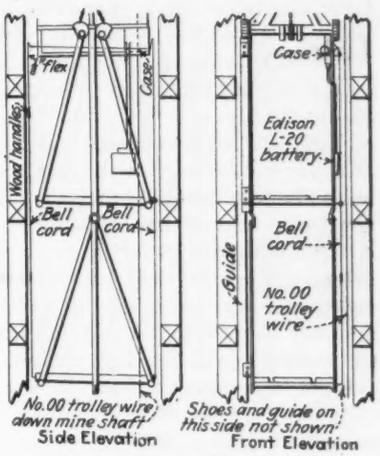


Fig. 2—Cage with signaling system attached.

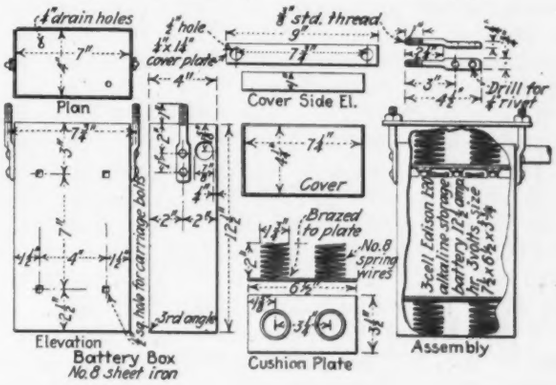
The essentials of the equipment comprise (1) a sensitive telegraph relay in the engine room, one end of the coil being connected to the hoisting cable, and the other end to a bare conductor supported in the shaft; (2) a small Edison battery on the cage, one terminal of which is permanently connected to the hoisting cable; and (3) a contact maker operated by chains running from top to bottom of the cages at each side, such that pulling on a chain completes (with a suitable accompaniment of noise) the contact from the battery on the cage to the bare conductor hung in the shaft. See Figs. 1 and 2.

Further details of the equipment follow:

The relay is a standard Western Union Bunnell 150 ohm non-polarized relay. See Fig. 1.

The battery is a three-cell L-20 Edison storage battery, having a capacity of 12½ ampere hours at 3 volts. See Fig. 3.

Fig. 3—Details of Edison L-20 battery.



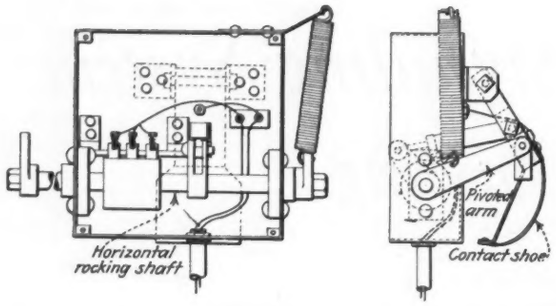


Fig. 4—Assembly of mine hoist signal case, cover removed.

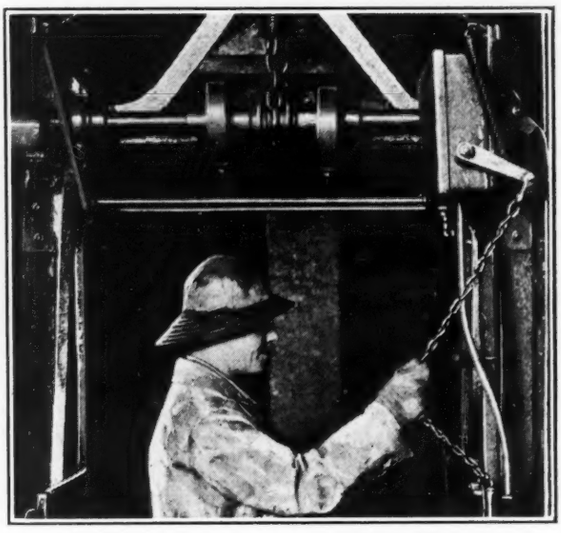
A bare conductor is provided which consists of No. 00 hard-drawn copper grooved trolley wire supported every 10 ft. down the shaft on regular trolley ears with suitable hangers lagged to the timbers. See Fig. 2.

Connections to the hoisting cable are made by suitable collector brushes on the hoist, and a flexible copper bond at the cage.

The cage contact device consists of a pivoted arm at the side of the cage with a wide curved contact shoe; a suitable mechanism operated by a long horizontal rocking shaft for moving the arm out into the shaft to make contact with the trolley wire; a single-contact electrical switch also operated by the same mechanism as a further safeguard against accidental making of the circuit; and suitable springs for holding the contact arm away from the trolley wire. See Figs. 2 and 4.

Operating chains are attached to arms on the operating shaft and hang down both decks of the cage, one chain close to each side of the hoisting shaft, so as to be readily accessible to a man standing at the shaft station when the cage is there, or to any men on the cage. See Fig. 2 and the two photographic reproductions.

The results of five years' experience with this system show that, in addition to its valuable safety features, it permits very rapid signaling, requires practically no maintenance other than the simple routine of changing and recharging the Edison cells once a month, and, in general, it is cheaper and less troublesome than the older systems.



Cager signaling from cage in Daly West shaft.

Flotation Means Big Increase in Michigan Earnings

EXPERTS have estimated that with the new flotation method, adapted by A. W. Fahrenwald, of the U. S. Bureau of Mines, to the treatment of amygdaloid native copper ore, the saving in copper per ton of ore treated will be 2¼ to 2½ lb. on ore from Calumet & Hecla Consolidated's Osceola lode; 2½ on Ahmeek; 2¼ on Isle Royale; 3½ to 4 on Copper Range; 2½ on Mohawk; and approximately 3 lb. on Quincy.

The saving in copper will be absolute, with no additional cost. But this saving is not all. A notable cost reduction on all metal produced from amygdaloid will be effected in smelting, through a cleaner concentrate and less slag. Smelting cost, now about $12 per ton of mineral, should be cut in two. Further economies can be made through the handling of bigger tonnages than is now possible. The new method is speedier than the present all-gravity process and will provide much more room in the mills than is now available.

On the basis of 1927 tonnage, Calumet & Hecla Consolidated, which stamped 1,151,557 tons of Kearsarge ore, practically all of it from Ahmeek, would save, at the rate of 2½ lb. per ton, 2,878,900 lb. of copper. This, at the present price of the metal, 14¾c., would yield $424,600. The saving on Osceola ore, of which a total of 791,961 tons was stamped in two mills, at the rate of 2¼ lb. per ton, would be 1,782,000 lb. of copper. This would yield $262,800. The total saving in copper alone would be $687,500 per year, or 35c. per share on outstanding stock. Earnings will be further increased through reduction of smelting charges and other possible economies.

Isle Royale, which stamped 465,100 tons of amygdaloid ore in 1927, would save on this basis, at 2¼ lb. per ton, 1,046,000 lb. of copper, worth $154,000. This saving in copper alone would be equivalent to $1.03 per share.

Copper Range stamped 592,045 tons of amygdaloid in 1927. A 4-lb. saving by flotation is not considered too high for Copper Range, which would yield, on the basis of 1927 tonnage, 2,368,000 lb. of copper. This would be worth $349,000, or 88c. per share on Copper Range stock.

Mohawk treated 759,878 tons of amygdaloid ore in 1927, which would make its saving at 2½ lb. per ton, 1,900,000 lb. of copper. This would be worth $280,200, equivalent to $2.43 per share on copper saving alone.

Quincy's saving also would be large at 3 lb. per ton, but an estimate is not made, because 1927 was not a normal year for this mine, owing to the shutdown of both shafts during the last half of the year on account of fire and "air-blast" damage. Quincy last year lost 5 lb. per ton on ore from No. 2 shaft and 4 lb. on ore from No. 6.

The use of flotation in treatment of amygdaloid ore will make it profitable to work lower grades of ore if such practice is considered desirable and the price of copper permits. During the last few years, lower grades have had to be sacrificed on account of the low price of the metal.

The "A-Tube"—An Improved Alternative to the U-Tube

THE ordinary U-tube has two serious disadvantages, the chief being the ease with which it is broken by slight pressure or tension exerted on its limbs in the same direction as the plane of the tube, according to A. O. Jones and F. Hobson, writing in *Chemistry and Industry*. The other objection is the fact that the bend often becomes choked with solid caked material, difficult to remove, and at which impatient students are prone to pick with wire or glass rod, to the detriment of the tube.

The form of tube shown in the sketch has several advantages over the usual U-tube. It is easily made, filled and cleaned, not being likely to break even when a solid caked in the limbs is picked at with a rod, and has great mechanical resistance to crushing in the hands owing to the shoulders being in contact at *B*. The wiring of the bends together at *A* makes it impossible to pull the tube apart by ordinary exertion. A minor advantage is that it can be more easily clamped by the cross tube, with less likelihood of breakage than is usual with the ordinary U-tube. When filling, material should be prevented from entering the cross tube by inserting plugs of asbestos or glass wool.

An improved form of U-tube

An obvious disadvantage is present in the dead spaces below the cross tube, but these can be easily minimized, are of no consequence in elementary work, and may sometimes be of advantage, permitting, for instance, the collection of liquid without interference with the flow of gas.

Taps may be provided at right angles to the plane of the tube, so as to permit it to be used upside down without the plugs falling out.

Gold Production in California Slightly Less, Though Widely Distributed

CALIFORNIA gold production was, according to J. M. Hill, $11,671,018 in 1927, or only slightly less, about a quarter million dollars, than in 1926. Placer production slightly exceeded lode production, but gold dredge production accounted for the greater part of the placer gold. In the distribution, Nevada County led in lode production, closely followed by Amador, the Mother Lode county. Yuba County produced $3,468,201 in gold, all from dredges and placers, and exceeded the production of Nevada County lode mines, which was $2,079,289. Sacramento County produced $1,211,278, the greater part from gold-dredge operations and the rest from placers.

According to Mr. Hill's table, 318 producers contributed to the lode gold production and 465 to the placer gold production. The average production would be $14,905 per producer. As many small incidental producers are included, the average production is not of significance. If the five leading counties are taken, Yuba, Nevada, Amador, Sacramento, and Sierra, the total production is $9,408,461 from 129 producers, or $72,933 each. However, only nine principal producers are included in these counties, and these account for the greater part of the production. The remaining production of the state is $2,267,557, derived from 654 producers, or an average of $3,459 from each. This more nearly gives the status of the individual small producer than the average first given.

Most significant is the fact that 32 counties out of 52 contributed to the gold production of California. Gold is therefore widely distributed, and many small operators are interested in its production. The gold-dredging industry is shrinking, and in a few years will no longer be able to reach its present production. Drift and hydraulic mining offer most promise of maintaining current output, as the small lode operator is barely holding his own. The future thus depends upon bettering the conditions that now limit hydraulic and drift mining. Resources are abundant.

Safety Toe Mining Shoe

AN ESSENTIAL PART of the equipment of a miner working under wet conditions is the all-rubber shoe, which is usually cut high and affords excellent protection from water. The all-rubber shoes are more durable under such conditions than leather shoes, as well as being water-tight. According to the *Anode*, Anaconda two years ago interested a rubber company in the development of a safety toe cap on shoes of this type. The reason for this lay in the fact that more than one-fourth of accidents causing the loss of more than fourteen days' time were due to mashed or broken toes. Steel toe inserts were first tried and were only partly satisfactory, as when damaged they required the services of a blacksmith. Hard-rubber toe caps broke under the impact. Finally a semi-hard rubber compound was developed, and this responded to the tests and was accepted for use in the new shoe. A pressure of 800 lb. was required to depress the toe cap to the extent of becoming painful to the wearer. On release of the weight, the toe cap returned to 90 per cent of its original height. Impact tests were also made, and the toe cap was found to withstand a blow of 270 lb. to the square inch before becoming depressed sufficiently to be painful. The toe cap returned immediately to normal position.

Effect of Stemming on the Efficiency of Explosives

IN VIEW of certain instances of a remarkable increase in the efficiency of explosives as a result of the use of stemming, which have come to the attention of the U. S. Bureau of Mines, a new edition of Technical Paper 17, dealing with this subject, has been issued, containing these details.

One company reports that, with the use of stemming, a test has shown a saving in powder consumption of approximately 20 per cent. Another company reports that the result of a three months' test in the stopes showed a saving in the consumption of explosives mounting to almost 25 per cent.

The full benefit of stemming will be obtained only if systematically enforced throughout a mine. It is necessary to provide plenty of suitable material at some convenient point, so that there is no excuse for not using it. This, however, is not all; intelligent and interested supervision is necessary to insure its general use and to overcome the passive resistance that many men offer to all innovations.

COMMENT AND CRITICISM

Explicit Directions for Handling the Witch Stick

THE EDITOR:

Sir — Articles recently published in your journal lead me to submit the following:

Not long ago I was talking with a man who felt very confident of his ability to find water with a divining rod, and being about to drill for water, I persuaded him to help me find it. He arrived, equipped with two divining rods, consisting of forked or Y-shaped twigs of cherry, about the diameter of one's little finger; in other words, fairly stout, and possessed of a good bit of elasticity and resistance to bending. The main stem and branches were each about 8-in. long. He explained it is necessary to use twigs from trees that bear fruit with a single stone, such as peach, cherry, or plum.

The exact manner of holding the divining rod is a point of importance. I can best describe it by inviting you to assume the following positions:

Stand erect.

Hold your elbows close to your chest.

Forearms up.

Fingers pointing up.

Palms towards face.

Have a friend place the divining rod in the position of an inverted Y, the main stem pointing upward, the two branches pointing downward at angles of about 45 deg. and resting in the crotches of your thumbs.

Close the fingers and thumbs on the rod with considerable force. In closing your fingers tightly you will bend the branches, the crotch of the thumbs serving as fulcrums. The elasticity of the wood causes a good bit of strain, and if you will take a really tight hold you will find that the divining rod has a very strong tendency to flop over and point to the ground.

Having critically surveyed the field, my divining friend started to walk across it. Presently he put the divining rod into action as described above. He increased the force of his grip and exerted himself so much that soon he began to shake and tremble, and being unable to support the strain longer, it flopped over and "divined."

To make the story complete, I should say that the place where water was divined to be seemed just as good a location as any, so we drilled at that point, but found no water at the 30-ft. depth estimated by the diviner. However, we kept drilling and at 70 ft. found a reasonable supply. A. KREBS.

Newport, Del.

[It is evident that the diviner, in this case, took no account of the pull of the moon. Early in July, when this adventure probably took place, the moon was full, and should therefore have been assumed to have the same effect as the body of water sought. Therefore, instead of the water being calculated at 30 ft., or more properly 35 ft., twice this figure would have been more nearly correct, or 70 ft., which, as Mr. Krebs says, is exactly where the water was actually found. Diviners should be more careful in their calculations, such errors casting a shadow of doubt over the whole art.—THE EDITOR.]

Did the Meteor Crater Meteorite Bounce Out?

THE EDITOR:

Sir—The idea that the meteorite that hit what is now known as Meteor Crater, in Arizona, might have been deflected, after striking a glancing blow, instead of embedding itself in the ground, is not mentioned in the account that was recently published in the *E.&M.J.*, but seems to me to be plausible.

This meteor was a mighty projectile, with a velocity much greater than that of a cannon ball. It did not strike the earth squarely, but with a glancing blow, and it is no more likely that it would embed itself in the rock at that point than that a cannon ball fired against the rock of Gibraltar at an angle would remain where it hit. Would the meteor not ricochet like a cannon ball, only in vastly greater bounds, according to its size and speed?

Projectiles do not leave a furrow where they come in contact with the earth, as might be supposed. If they strike at an angle they push the ground in front and sideways, and jump clear, leaving a round-shaped depression. Try throwing a stone so as to make a groove or furrow. If this meteor had struck at so great an angle that it could not bound clear, but fell back into the hole, it should be on top of the other detritus, because, being larger and heavier, it would go farther and higher than the smaller and lighter stuff, and would come down last and be there now.

We do not know at what speed the meteor left the cavity, nor at what angle, so it is impossible to form an estimate of how far it would go before striking earth again; it might be a hundred miles or a thousand. The marks show that it was going in a southerly direction, so why is it not logical to look for it in that direction?

Over 300 miles in a southerly direction an iron meteorite weighing over 3,400 lb. was found in the prehistoric town of Casas Grandes, Mexico, in an old temple where it had evidently been doing duty as an object of worship. This meteorite is in the Smithsonian Institution. Over 600 miles in a southerly direction from the Arizona crater lies the great Bacubirito meteorite. Mr. Henry A. Ward gives an account of his visit to it, with illustrations, in the *Scientific American*, page 288, of Nov. 1, 1902. He says it took 28 men a day to dig away the dirt so he could examine it, and he shows a picture of the men standing around the meteorite. He cut off 11 lb. of it, which is in the Museum of Natural History in New York. This is also an iron meteorite. Casas Grandes is about 75 miles east of a line drawn between Bacubirito and Canyon Diablo. It is not improbable that the inhabitants moved their iron 75 miles to their temple.

Both of these may be pieces of the meteor crater meteorite, broken off in passage. The Bacubirito meteorite lies in the valley of the Sinaloa River at an altitude of 2,000 ft. The altitude of the ground south of the river is 8,000 ft., and then there is a slope down to the coast. If the high ground did not catch the great meteor, the indications are that it flew high, and reached the Pacific Ocean west of Mexico on the first bound, leaving only fragments to mark its path. F. E. STONE.

601 Murdock Building,
Wichita, Kan.

Uniform Methods of Mine Accounting

THE EDITOR:

Sir—The article in your issue of Feb. 11, captioned "Uniform Systems of Mine Accounting," interested us intensely, and we agree with all that you say. We are engaged in auditing the books of a number of mining companies in the Southwest and in Mexico. We should like to see published communications from individuals, societies, or other agencies dealing with this subject, particularly describing approved methods of accounting for mines of various types.

BIXLER and DEISLER,
by P. F. Deisler.

El Paso, Tex.

Consultation

Copper Companies in South America

"I am a graduate metallurgical engineer and desire to become connected with one of the large copper companies, operating in South America. Can you give me a list of the reputable companies operating in that region?"

The important South American copper companies are:

American Smelting & Refining Company, 120 Broadway.
Andes Copper Mining Company, 25 Broadway.
Braden Copper Mines Company, 120 Broadway.
Chile Copper Company, 25 Broadway.
Cerro de Pasco Copper Corporation, 44 Wall St.
Central Peru Copper Company, 115 Broadway.
United Verde Copper Company, 111 Broadway.

All of the above office addresses are in New York City.

Federal Mineral Leases in Eastern Forest Regions

"What is the situation in connection with the issuance of prospecting permits, and filing mineral land claims on land within the Appalachian National Forests?"

As a result of increased transportation facilities, improved metallurgical practice, and a growing demand for clays and other non-metallics, mineral deposits on forest lands which were acquired by the federal government in a number of the thirteen original states under the Weeks Act of March 1, 1911, may again become important. Issuance of prospecting and mining rights on these lands rests with forest officers of the several districts, who fix the royalty rates, ranging from 2 to 8 per cent. No royalty is charged during any period of three months when the royalty does not exceed $50. All royalties collected are accounted for by the forest officers as miscellaneous forest receipts, and are not listed as separate items.

Lands acquired under the Weeks Act are usually purchased in fee and without the reservation of minerals, except oil and gas on lands in the Allegheny forest in western Pennsylvania. This is a region of great productivity in various underground resources, and the owners usually reserve their mineral rights. Here and there throughout the entire Appalachian system, subsurface rights are retained by the vendors, subject to operations under rules of the Secretary of Agriculture, which rules are designed to protect the growth of timber and promote public welfare.

Where the mineral rights are reserved to the vendors for a definite period of years, and where they are permanently outstanding in third parties, the government does not acquire jurisdiction over the minerals, and the price of the land is discounted in the price negotiations.

Crushing and Grinding

"Can you furnish me with information concerning the distinction between the process of grinding and that of crushing?"

The distinction between crushing and grinding is largely a question of nomenclature, and, consequently, a number of arbitrary and more or less empirical definitions have been adopted by different authorities, and in various localities. The most widely accepted definition of crushing is that it is a process of size-reduction utilizing squeezing, cracking, or breaking by impact; whereas grinding is generally considered as a process of size-reduction employing attrition or abrasion as the medium of reduction.

An arbitrary size-point at which crushing stops and grinding begins is maintained as the best definition by some authorities. For instance, it might be said that reduction in size to pass a 1-in. or a ½-in. ring may be termed crushing, whereas reduction in size or comminution below that point constitutes a grinding process. However, this seems an unfortunate distinction with little scientific basis. Rock breakers such as jaw and gyratory crushers, and rolls, cone, and disk crushers, are essentially crushing devices, though they do a certain amount of grinding, as an incident to their major function. Chilean, Huntington, ball, and tube mills, on the other hand, are typical grinders, even though some incidental crushing is done by them. The stamp mill, particularly as used in the old gold mill, when 2-in. ore was reduced in a single operation to pass a 30-mesh screen, is essentially a crushing device, although the diminution extended into the field that nowadays is done by a grinding machine. Ball mills and tube mills do the work more cheaply. In summing up it appears that the logical distinction is based on the method of securing the result, rather than upon the character of the result—that is the size of the resulting product.

By the Way

Copper Tips That Bore Good Fruit

FROM a stope in a copper mine to the bridge of the "Aquitania" is a long step, but—

In 1880, at the age of fifteen, the late Sir James Charles went to sea. His early career was in sailing vessels rounding the Horn. One boat on which he sailed burned at sea, one was wrecked in a collision, and another sank in the North Sea. Otherwise his career was comparatively free from disaster. For the last eighteen years he had been in command of one of the largest transatlantic liners of the Cunard line, and for many years had been Commodore of the fleet. He had crossed the Atlantic 726 times, traveling well over two million nautical miles. Arrangements had been made for him to retire on a pension after Aug. 2, the occasion of his 63d birthday. On June 30 he left Cherbourg to make his final round-trip passage on board the "Aquitania." He had 30 consecutive hours of travel in the fog before reaching New York; and after only 48 hours in port he started back for another foggy voyage. While in New York he commented on the strain of continuous hours on the bridge. Sir James was with the pilot when his ship came safely to anchor at Cherbourg on July 15. Ten minutes later he collapsed in his cabin, and within an hour he died. One may easily imagine that nothing but the will to do kept him at his post during the final days of the voyage. True to the traditions of the sea, he brought his ship safe back to the home port.

According to the *New York Times* the Commodore was to have received a pension of $4,000 after his retirement. Judged by this, his remuneration as an active officer could not have been very large when one considers the responsibility resting on the shoulders of the master of a great liner; nor is it likely that he saved any great amount of money from his income as a captain, for the support of his widow who lives at Southampton. It is therefore comforting to read in the account in the *Times* that he has had a considerable income as a result of investments in copper mines made upon the recommendation of his old friend Simon Guggenheim, who had often been a passenger on his ship.

One on Balliet, or Maybe It's Hoover

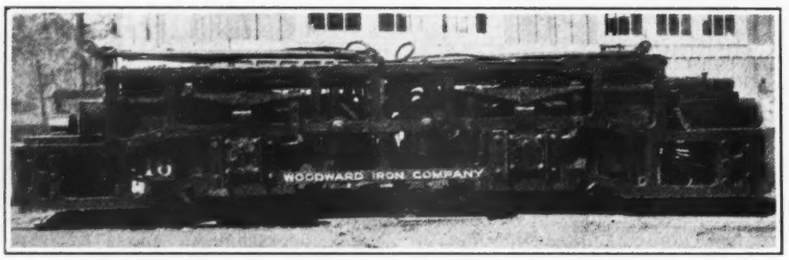
LETSON BALLIET, one of the well-known mining engineers in the West, is a strong advocate of Mr. Hoover for President. After the conventions, when everybody was commenting on the choice of Presidential candidates by the two parties, Mr. Balliet casually remarked to a subordinate attaché of a Reno hotel, "I hope to see Hoover elected."

"Hoover—Hoover" grunted the hotel flunky, "what do we want him for?"

"He's a mining engineer——"

"Huh! I can show you two hundred of them hanging around this town, and they ain't no good."

INDUSTRIAL PROGRESS



A 15-ton, 260-hp. two-motor Baldwin-Westinghouse locomotive with semi-magnetic double-end control, for Woodward Iron Company

Trend Toward Larger Mine Locomotives for Main Haulage Service

RECENT developments indicate that the tendency in mine-locomotive design is in the direction of the heaviest and most powerful units that operating conditions will permit to be used, according to G. H. F. Holey, of the Westinghouse company. The reason back of this trend is the desire on the part of progressive coal producers to handle more tons at reduced cost and in less time. In the development of these units there is much to interest the metal-mine operator who has a haulage problem.

Large-capacity units are required when the hauls are long, when adverse grade conditions exist, or the output of the mine is large. It is obvious that the larger the locomotive the fewer will be required, resulting in a reduction in labor charge and lost time in dispatching. This is particularly noticeable where the main haul is provided with a single track and passing tracks are required. Moreover, where labor-saving devices have been installed to increase production, heavier and larger capacity locomotives may offer advantages.

Motor Capacity Increased

Formerly the motor capacity was of the order of 10 to 12 hp. per ton. The capacity that can now be applied on locomotives will be in the order of 12 to 20 hp. per ton. Formerly, two 90 to 95-hp. motors were considered desirable for 13- and 15-ton locomotives, whereas in recent years motors of 115 to 150-hp. capacity each, have been designed for 13- and 15-ton locomotives. Even where the motor design has been confined to a 36-in. gage track, 130-hp. motors are available for application on 13- and 15-ton locomotives having two-motor equipment.

Mines to be equipped with these large locomotives necessarily require heavy rails, good bonding, and good overhead or trolley wire construction, with the proper feeder cable. In Table I is given a recommended rail weight for locomotives from 13 to 37.5 tons.

Table I—Recommended Rail Weight; Pounds per Yard

Weight of Locomotive, Tons	Two-Axle Locomotive	Three-Axle Locomotive
13	40 to 50	..
15	50	40
20	60	50
22.5	60	50
25	70	60
30	.....	70
35 and 37.5	.....	80

Heavy Grades and Long Hauls

Severe adverse grade conditions in a great many cases are the ruling factor in the selection of large locomotives with large capacity motors. Such a condition can be illustrated by a 12,000-ft. haul one way, of which the average grade against the load is approximately 4 per cent for a distance of 8,000 ft. and the maximum grade 6 per cent for a distance of 600 ft., with the remainder of the haul varying from 0.1 to 0.5 per cent in favor of the load. Over a period of twenty days, two 22.5-ton locomotives average thirteen trips per day, producing at the surface 682 loaded cars.

To produce the aforementioned output it was necessary for each locomotive to average approximately 41 miles a day in an eight-hour shift. It is obvious that under the severe operating conditions at least three and possibly four 15-ton locomotives would have been required, which, in turn, would have increased the labor charge and no doubt caused confusion, particularly from a dispatching standpoint, as this was a single-track mine with only one passing track at the top of the 8,000-ft. grade.

Haulage Capacity

The haulage capacity of locomotives on grades up to and including 5 per cent are given in Table II on the basis of the mine car being equipped with anti-friction bearings.

Table II—Hauling Capacity of Mine Locomotives

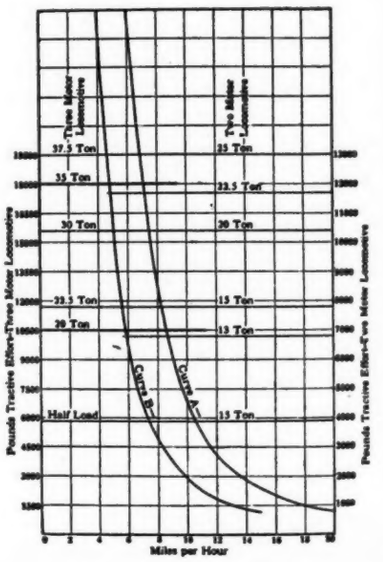
Weight of Locomotive in Tons	Level Track	Tons Trailing Load 1	2	3	4	5
13	650	210	120	85	60	50
15	750	240	140	95	70	55
20	1,000	320	185	125	95	75
22.5	1,125	360	210	145	105	80
25	1,250	400	230	160	120	90
30	1,500	480	280	190	140	110
35	1,750	560	325	220	165	152
37.5	1,875	600	345	235	175	135

The control for these locomotives is of the series-parallel type, the transition from series to parallel being made by progressive steps on the accelerating drum of the controller from the full-running position of the motors in series to the accelerating position with the motors in parallel. Overload protection is provided with overload relays.

Speed

Speeds of two- and three-motor locomotives are shown in an accompanying illustration. Curve A (Fig. 1) illustrates the locomotive speed at the rated tractive effort for the corresponding rated drawbar pull when the locomotive is equipped with 150-hp. motors, and Curve B when it is equipped with 125-hp. motors. It will be seen from either one of these curves that the speed change is very gradual and apparently not excessive when going from the rated drawbar pull or tractive effort of the

Fig. 1—Tractive effort curves of two- and three-motor locomotives. Curve A for 150-hp. motors. Curve B for 125-hp. motors



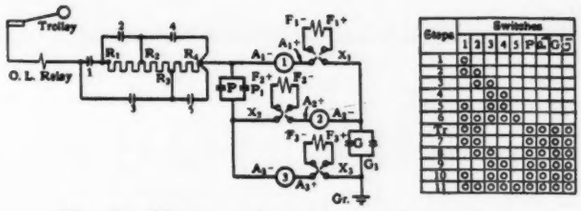


Fig. 2—Diagram of main control circuits on three-motor locomotives

two-motor 25-ton locomotive to the two-motor 15-ton locomotive or from the three-motor 37.5 ton locomotive to the three-motor 20-ton locomotive. The speed of the two-motor 15-ton locomotive when equipped with 150-hp. motors at a rated drawbar pull of 7,500-lb. or 7,800-lb. tractive effort is approximately 10.25 miles an hour, and at half load or 3,900-lb. tractive effort in approximately 12.5 m.p.h. These speeds are at the rated voltage of either 250 or 500 with the motors operating in parallel. The drawbar pull and speed for two-motor and three-motor locomotives equipped with motors of the characteristics shown by Curves A and B are given in Table III.

Fewer Locomotives Needed

With the large motor capacity, in addition to increasing the tonnage and reducing the number of locomotives, motor maintenance is necessarily reduced, as the slipping point of the wheels on locomotives equipped with 15 to 20 hp. per ton approximates very closely to the normal rating of the motor, and locomotives equipped with approximately 12 to 15 hp. per ton approximate the slipping-point rating of the motor. To insure ample bearing capacity, the motors are equipped with tapered roller bearings.

Table III—Rated Drawbar Pull and Speeds of Mine Haulage Locomotives

Locomotive Weight in in Tons	Drawbar Pull in Pounds	Speed Miles per Hour Two-Motor	Speed Miles per Hour Three-Motor*
Based on Curve A			
15	7,500	10.3	.....
20	10,000	9.5	.....
22.5	11,250	9.1	10.25
25	12,500	8.9	9.9
30	15,000	....	9.5
35	17,500	....	9.1
37.5	18,750	....	8.9
Based on Curve B			
13	6,500	7.9	.....
15	7,500	7.6	.....
20	10,000	7.1	7.9
22.5	11,250	6.8	7.6
25	12,500	6.6	7.4
30	15,000	....	7.1
35	17,500	....	6.8
37.5	18,750	....	6.6

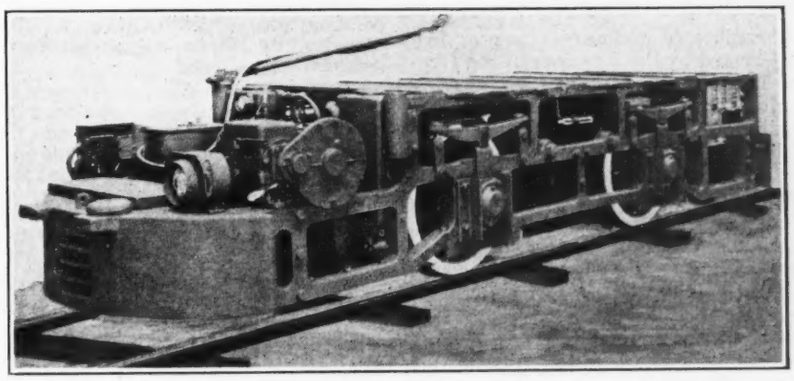
Curves—The two-motor locomotives are suitable for hauling trips around curves of a radius as low as 50 ft. and the three-motor locomotive for curves of 90-ft. radius. As a protection to guard against derailment on the sharp curves for three-motor locomotives, it is generally desirable to provide a guard rail on the inside of both the inner and outer rails on the curve.

Long Hauls—At present, hauls of two to three miles are not uncommon in coal-mining practice, and as the development of the mines is progressing at a rapid rate, the average haul in some will approximate 5 miles one way from the surface or shaft bottom. Irrespective of grade conditions, such a haul will require locomotives of increased speeds as well as increased capacity.

Now under construction is a 38-ton locomotive equipped with three motors and semi-magnetic control for service where the grade conditions are severe and average 2.4 per cent for a haul of 21,650 ft. The maximum grade in this haul is 5.6 per cent for a distance of 1,000 ft. To get out the required tonnage the locomotive with the loaded and empty trip must take a round trip every hour, of which 15 to 20 per cent of this time must be allocated to making up the empty and loaded trip. Such a production schedule requires not only a large locomotive in weight but also a locomotive of ample motor capacity and high speed. High-speed equipment will be required, as the round trip haul is approximately 8 miles. The rated drawbar pull of the 38-ton locomotive will be 19,000 lb. at 8 miles per hour. The speed will be approximately 9 miles per hour when hauling 60 cars up the average grade.

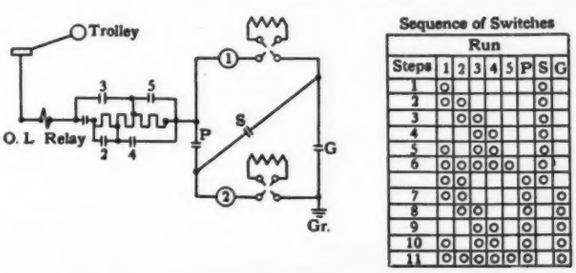
Equalization

The track conditions on the main haulage are generally such that good alignment and fair surfacing can be depended upon. The track conditions, however, adjacent to the face are more severe, as this remains more or less a temporary condition until final grading for permanent track is made. To meet the track irregularities that can and do exist on the main haulage, these large locomotives are arranged on the two-motor equipment with a cross-equalizer between the weight-carrying springs on one pair of journals. On the three-motor locomotive side, equalizing bars are connected on each side of the locomotive between the weight-carrying springs of two pairs of driving-axle journal boxes, and a cross-equal bar is provided for the weight-carrying springs on one axle. This construction provides a three-point support for the spring-carried parts of the locomotive and permits the wheels to adjust for track irregularities that might exist between rails or on the rails themselves and insures a more even weight distribution at the wheel treads, which reduces the tendency to derail.



A 20-ton, 300-hp. two-motor Baldwin-Westinghouse locomotive with semi-electro-pneumatic control, air brakes, air sanders and air whistle, for Bertha Consumers Coal Company

Fig. 3—Diagram of main control circuits on two-motor locomotives



INDUSTRIAL NOTES

The Ruth Company has moved its offices in Denver to the Continental Oil Building at Eighteenth Street and Glenarm Place.

The Curtin-Howe Corporation, wood-preservation engineers, 11 Park Place, New York, has appointed Kenneth M. Bailey technical sales representative at

New Orleans, La. Mr. Bailey's address will be 515 N. O. Bank Building.

The National Flue Cleaner Company, Inc., of Groveville, N. J., has appointed the following as its representatives in the South: Fuel Efficiency Engineering Company, American Trust Building, Birmingham, Ala.; A. S. Furtwangler, 4 South Broad St., Charleston, S. C.; Reed & Duecker, Inc., 171 North Main St., Memphis, Tenn.; Buckmaster-Luck-Malochee, Inc., Industrial Homestead Building, New Orleans, La. and Henry Eggelhof, Construction Industries Building, Dallas, Tex. The foregoing will act as distributors for the National soot blower.

W. S. Lynch has been appointed district manager of the Cincinnati office of the Chicago Pneumatic Tool Company. He will succeed T. G. Smallwood. At the same time announcement is made of the appointment of A. M. Andresen as acting district manager at Seattle, Wash., with offices at 1743 First Ave. South.

Smith-Emery Company, whose offices and laboratories have been at 245 South Los Angeles St., Los Angeles, since 1910, have moved to 920 Santee St., Los Angeles.

The office of honorary vice-president was created by the directors of the General Electric Company at their meeting on July 6. The board elected to this new office three prominent officials, including J. R. Lovejoy, vice-president, who has served the company 42 years; George F. Morrison, vice-president, associated with the company 45 years, and B. G. Tremaine, one of the organizers of the National Lamp Division of the General Electric Company. All three are directors of the company and will continue to function as such, and will retain their association with the several departments of the company's activities with which they have been so closely identified. Their new title is conferred on them in recognition of their long and valuable services to the company. T. W. Frech, manager of the incandescent-lamp department of the company, was elected to the position of vice-president in charge of the incandescent-lamp department, and Dr. W. R. Whitney, director of the research laboratory, was elected a vice-president of the company and director of research.

Combustion Engineering Corporation, 200 Madison Ave., New York, has appointed W. O. Renkin as manager of its industrial furnace department, effective Aug. 1.

A. W. Lewis has been appointed acting resident manager in charge of the Cleveland works and sales office of the United States Cast Iron Pipe & Foundry Company.

The Magnetic Manufacturing Company has discontinued its former sales office and has opened a direct factory branch office at 211 North Desplaines St., Chicago. All business in the Chicago district will be handled from this office in the future.

Robert J. Anderson, who has been serving as director of research of the Fairmont Manufacturing Company, Fairmont, W. Va., has been elected vice-president of the company in charge of production. William J. Lange, metallurgist, has been made technical supervisor.

H. N. Spicer, of the Dorr Company, accompanied by Mrs. Spicer, has returned from a seven months' trip to Australia, the Federated Malay States, China, and Japan, in connection with his company's interests in these countries.

J. W. Cliff has recently joined the MacGregor Valve Company, St. Louis, as production manager.

BULLETINS

ROPE SLINGS—John A. Roebling's Sons Company, Trenton, N. J. Bulletin on wire rope slings. Comprises 86 pages.

WELDING—Oxweld Acetylene Company, 30 East 42d St., New York. Bulletin on oxyacetylene equipment for welding, cutting, brazing, lead burning, heating, and decarbonizing. Fifty-seven pages.

DRIFTER DRILLS—Cleveland Rock Drill Company, Cleveland, Ohio. Bulletin No. 81. Model D8 drifter. Eight pages.

MOTOR BEARINGS—Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 156, on Wagner bearing construction. Four pages.

ELECTRIC FUSES—Chicago-Jefferson Fuse & Electric Company, a consolidation of Jefferson Electric Manufacturing Company and Chicago Fuse Manufacturing Company, both of Chicago, have just issued a combined catalog of their electrical products. Copies may be obtained by writing directly to the factory at 1500 South Laflin St., Chicago.

WOOD PRESERVATIVE—Curtin-Howe Corporation, 11 Park Place, New York. Folder on zinc meta-arsenite.

COMPRESSORS—Chicago Pneumatic Tool Company, 6 East 44th St., New York. Bulletin No. 797. Portable gasoline engine driven compressors in size of 100, 160, 220, and 310 cu.ft.

CONVEYING, ELEVATING, TRANSMISSION —Link-Belt Company, Chicago. General Catalog 500. This catalog covers the complete chain, sprocket, power transmission, elevating and conveying and engineering divisions of the company. It comprises 1088 pages.

MINE LOCOMOTIVE HEADLIGHT — Ohio Brass Company, Mansfield, Ohio. Bulletin 139D. The Crouse-Hinds improved type MS incandescent headlight for mine locomotives. Eight pages.

COMPRESSORS—Sullivan Machinery Company, Chicago. Bulletin 83A. Angle compound air compressors, 8-in. stroke, sizes WJ3 and W13.

STACK INSULATION — Celite Products Company, 1320 South Hope Street, Los Angeles. Bulletin No. 141. "The Insulation of Breechings and Stacks," (with Sil-O-Cel standard brick). Two pages.

LUBRICATION—E. F. Houghton & Company, Philadelphia. Booklet entitled "Lubrication for Safety and Economy." Twenty pages.

PULVERIZED FUEL — Combustion Engineering Corporation, 200 Madison Avenue, New York. Catalog U-3. Lopulco unit system for burning pulverized fuel. Twenty-eight pages.

TRACTORS—Monarch Tractors Corporation, Springfield, Ill. (subsidiary of Allis-Chalmers.) A four-page pamphlet on the Monarch 50 tractors.

OIL TESTING—General Electric Company, Schenectady, N. Y. Bulletin GEA-832. Portable oil-testing sets for field use. Four pages.

PUMPS—Ingersoll-Rand Company, New York. Form 7158. Multi-stage centrifugal Cameron pumps designed for high-pressure boiler feeding, hydraulic service in steel mills, mine drainage, pipe lines and similar technical applications. Thirty pages.

BLOWERS — Connersville Blower Company, Connersville, Ind. Bulletin 17A. Types SF and SFH blowers of medium and larger capacities on low pressure service. Eight pages.

METERS — Sangamo Electric Company, Springfield, Ill. Bulletin 75. Sangamo meters, type HB maximum demand register. Eight pages.

WELDING—General Electric Company, Schenectady, N. Y. Bulletin GEA-423A, entitled "Arc Welding in G-E Factories," This is a description of the company's accomplishments in this line. Twenty-eight pages.

The company has also issued another bulletin, GEA-995, entitled "Arc Welding in Industry." This illustrates the application of arc welding to group and basic operations commonly found in industrial plants. It comprises 32 pages.

WELDED PIPING—Linde Air Products Company, 13 East 42d St., New York. Bulletin entitled "Oxwelded Industrial Piping." Ten pages.

PATENTS

HAMMER DRILL. No. 1,675,326. July 3, 1928. Forrest H. Blanding, assignor to Chicago Pneumatic Tool Company, New York.

ROTARY KILN. No. 1,675,416. July 3, 1928. P. T. Lindhard, assignor to F. L. Smidth & Company, New York.

GRINDING-MILL SCREEN. No. 1,675,417. July 3, 1928. W. F. McMahon, Riverside, Cal.

GRINDING MILL. No. 1,675,658. July 3, 1928. John Mursch, assignor to Buffalo Hammer Mill Corporation, Buffalo, N. Y.

ORE-CONCENTRATING APPARATUS. No. 1,675,955. July 3, 1928. Howard E. Petro, Salt Lake City, Utah.

SINTERING. No. 1,676,720. July 10, 1928. Paul Anderson, Vasteras, Sweden.

An ore sintering machine, having a horizontal rotatory frame with sintering pans distributed radially about its center.

GEOPHYSICS. No. 1,676,779. July 10, 1928. Shirl Herr, Crawfordsville, Ind.

A device for underground prospecting, involving the application of an electromagnetic method.

ORE CONCENTRATION. No. 1,677,416. July 17, 1928. Burnell R. Tunison, Elizabeth, N. J.

This covers a process of concentrating minerals by froth flotation by floating a mineral pulp in the presence of the extracted oily sulphurous component of a sulphurous petroleum oil, the component being soluble in caustic and insoluble in water.

FLOTATION. No. 1,671,590. May 29, 1928. Cornelius H. Keller, assignor to Minerals Separation North American Corporation, New York.

This covers the process of agitating a pulp with a mineral-frothing agent and sufficient of a material containing a substantial proportion of an alkaline earth metal xanthate to produce a froth that will contain a large proportion of the mineral, and separating the froth.

NEWS OF THE WEEK

Summary

DURING the first half of 1928, two new companies joined the three steady producers in the Park City district of Utah. A complete review of activities in, and shipments from, this camp is presented on pages 148-149.

* * *

J. Y. Murdoch, president of Noranda Mines, has made an official statement on the situation in the lower levels of the property in the Rouyn district. A new shaft is being considered. Page 151.

* * *

Under the direction of C. W. Wright, the U. S. Bureau of Mines will undertake a special study of mining methods as employed in the Western mining districts. Further experimentation with geophysical methods is being carried on at Mineville, N. Y., and Cornwall, Pa. Page 146.

* * *

Kino Copper, situated in the Patagonia Mountains, near Nogales, Ariz., has been optioned by a group of New York men. If the option is exercised, a payment of $750,000 in cash and a percentage of the stock of the new company will be made to the present stockholders. Page 150.

* * *

Calumet & Hecla awards contract for a new mineral storage building at its smelter at Hubbell, Mich. When this plant is completed and the new furnace is put into operation, the smelter of the company will have been fully modernized. Page 146.

* * *

The world's largest tin smelter went into operation at Bootle, Lancashire, England, on July 13, when the Penpoll works was started by Lord Derby. Anglo-Oriental owns the plant. Page 146.

* * *

The power supply of several important mining districts in Chihuahua, Mexico, may be cut off as a result of extended drought in certain parts of that state. Page 151.

Timmins Outlines Conditions Prevailing at Hollinger Consolidated

N. A. TIMMINS, president of Hollinger Consolidated, has made public a statement concerning operations at Ontario's largest gold mine. The recent depreciation of the stock has given rise to many unfavorable rumors, and it is expected that Mr. Timmins' statement will make the position of the company clear. He said, in part:

"There is no disagreement or lack of co-operation among the higher officials. On the contrary, the utmost harmony prevails, and no changes in the staff are contemplated. No more than seasonal changes have occurred among the employees, who number about 2,350 as against an average of 2,497 during the year 1927. A number of plans have been under consideration with a view to further work on the Kamiskotia claims, which represent an investment of about $350,000, and it is expected that one will presently be evolved which will appeal to the directors, and result in turning this asset to good account. The company now holds 18,000 shares of Noranda stock. The backfilling situation, to which reference has frequently been made, is perfectly satisfactory to the management and need cause no uneasiness. Operations to July 7 show the following results; in some cases the figures are approximate only: Tons milled, 916,652; average tons per day, 5,053; value per ton recovered, $6.22; profits from all sources, $2,000,900. At present, the daily tonnage milled is about 4,685 tons, and the value per ton recovered $6.35. The fire of Feb. 10 has cost to date $228,000 in actual outlay, which is not likely to be increased to any appreciable extent, besides eleven days' complete shutdown and subsequent delays in starting."

Mr. Timmins further pointed out that operating profits had decreased largely because of the more extensive development program under way. The objective of 4,000 ft. depth at the Schumacher shaft should be attained within two months. Development work now in progress should definitely determine conditions at depth, which have been quite favorable in the adjoining McIntyre-Porcupine mine. No change in the dividend rate is contemplated.

Whitedelf Mining Strikes Additional Ore at 200 Level

DEVELOPMENTS on the 200 level of the new shaft being sunk by Whitedelf Mining, at Clark Fork, Idaho, have proved large additional tonnages of lead-silver ore. According to Compton I. White, manager of the property, the vein is averaging 4 ft. in width, of which 1 ft. is high grade and the remainder milling grade. The south drift at the 200 level is now in 120 ft. and the north drift has been driven 140 ft. The new shaft is being sunk from the lower tunnel, and will be bottomed at 400 ft., or 700 ft. below the surface.

J. P. Delaney, president of the Whitedelf company, states that the entire Clark Fork district is very active. Among the interests reported to be seeking prospects are the Day brothers, of Wallace, who own the Hercules and other Coeur d'Alene mines.

At the Regal mine, which is controlled by Messrs. Delaney and White, the No. 1 tunnel is in 85 ft. The ore is continuous along the footwall, with lenses on the hanging wall. The grade is becoming better with depth and is also showing a small gold content. A contract has been let for crosscutting to open the vein on the other side of the outcrop. A road will be built to the property and mining equipment to facilitate development installed. The company plans to obtain its own power from a near-by stream.

Black Eagle Milling Ore From Dumps

Black Eagle Mines is shipping 150 tons of lead-silver concentrates from the Black Eagle group of ten claims, in the Black Eagle Mountains, east of Mecca, in Riverside County, Calif. The 50-ton mill is at present working on material from an 8,000-ton dump with lead, silver and a small gold content. Twelve men are employed. Underground development of the orebodies is also being carried on.

The Pacific Gas & Electric Company is preparing to extend its power line to the Georgetown district, El Dorado County, to serve the Georgetown Mines group and the Woodside and Eureka properties, which are being reopened.

Penpoll Tin Smelter Put Into Operation

ON JULY 13, Lord Derby started the fires in the new Penpoll tin smelter, controlled by Anglo-Oriental, situated at Bootle, Lancashire, England. The new smelter is said to be capable of treating half of the world's supply of tin ore. It is of particular interest because of the equipment with which it is provided and which, it is said, will reclaim all the tin that ordinarily escapes in smoke and gases. It is estimated that about 170 tons of tin will be retrieved from the furnace smokestacks every year. The London Tin Syndicate is the name of the operating company.

Contract Is Awarded for New Calumet & Hecla Building

Seneca Mine Is Being Kept Unwatered, Pending Resumption of Operations —Copper Shipments Brisk

CALUMET & HECLA Consolidated has awarded a contract for the erection of a mineral storage building at its smelter at Hubbell, in the Michigan copper district. When this structure and the new smelting furnace now under construction are completed, the plant will have been fully modernized and equipped for economical operation. Two large melting furnaces and two large refining furnaces will give ample capacity for the smelting of mineral from all producing units of the company, including Isle Royale, which, pending completion of smelter improvements, is sending its mineral to the Michigan plant at Houghton.

The new melting furnace now being built will have a capacity of 225 tons of mineral per day, and molten metal from it will flow by gravity to either of the two refining units. The melting furnace already in commission charges by gravity. One of the new refining units is especially equipped for melting and refining large masses of copper and for making billets and other irregular shapes.

To date no word has been received regarding the proposed reopening of the Seneca mine. The pumps are still in operation, keeping the shafts in good condition. Many applications for work have been received, and no difficulty should be experienced in building up an efficient force. If the property is reopened it could produce about 1,500 tons per day from present openings The company had work under way in three shafts when operations ceased.

Ojibway, which lies between Seneca and Cliff, no doubt will attract attention if important developments are made by Calumet & Hecla Consolidated in Cliff and Phoenix lands. The company owns a large acreage in Keweenaw County, crossed by the Kearsarge and other important beds. It has two shafts, each about 2,000 ft. in depth, from which exploratory drifts and crosscuts could be driven. That the company thinks well of its eventual possibilities is shown by the fact that it increased its mineral holdings a few years ago by 480 acres adjoining the property, giving it a total of 3,000 acres.

Copper shipments out of the Michigan district are brisk this month. Metal is moving in all directions and a considerable volume is again going out by rail.

Mining Division of Bureau of Mines Plans Study of Mining Methods

Investigation to Be Made Into Drilling, Blasting, Costs, Underground Transportation, and Labor Efficiency—Field Studies at Mineville and Cornwall Should Add to Geophysical Knowledge

By Paul Wooton
Special Washington Correspondent

PLANS have been prepared by the mining division of the U. S. Bureau of Mines for a general study of metal-mining methods and costs throughout the Western states. Additional personnel is being engaged for this purpose. The work later will be extended to the Central-Eastern states. There will be a special investigation of methods of breaking and of handling ore, which will include details of types of ore chutes; underground transport and costs; drilling and blasting practice; labor efficiency, with a description of and results obtained by the different contract and bonus systems; notes on underground management of labor; and methods of sampling and estimating.

In the carrying forward of its study of geophysical methods of prospecting, the Bureau is conducting field studies this summer at Mineville, N. Y., and at Cornwall, Pa., where magnetite deposits at different depths have been located by drill holes. Surface surveys in an attempt to indicate the size and depths of these deposits are being made by the old and certain new electrical methods, so as to verify experimentally their relative efficiency. Interesting results are being obtained. Together with the investigations, new methods and improved instruments are being developed. Further problems for future investigations are being worked out.

A start was made on this work last summer at Boulder, Colo., where magnetic, torsion balance (gravitational), and electrical methods were tested in the location of a magnetite deposit near the surface. This year's work is being conducted by Dr. A. S. Eve, Dr. D. A. Keys, William Rooney, and O. J. Gish, under the general direction of Dr. F. W. Lee, formerly of Johns Hopkins. The Bureau's technical paper No. 420, written by Dr. Eve and Dr. Keys, comments on the principles involved in electrical, gravitational, magnetic and seismic methods of prospecting. A report on the results of last year's work by Dr. Eve, Dr. Keys, and Dr. C. A. Heiland is now ready for publication.

In addition to the field work, a series of laboratory conductivity tests is being made on the drill-core samples of rock and ore from the localities being surveyed. Tables showing the relative resistance of various rocks and ores will be prepared.

The engineer in charge of the mining division, under which this work is being done, is C. W. Wright, who returned to this country recently after having conducted mining operations in Italy for the last twenty years.

Three Salt Lake Valley Teams to Enter Butte Contest

THREE first-aid and mine rescue teams from the Salt Lake Valley district will compete in the International Contest to be held at Butte, Mont., Aug. 20-22, under the auspices of the U. S. Bureau of Mines, according to Dr. Arthur L. Murray, district surgeon of the Bureau. The three companies entering teams are Utah-Delaware, Utah Copper, and Tintic Standard. Teams of these companies are now being trained by the personnel of mine rescue car No. 9 of the Bureau of Mines, which arrived at Bingham, Utah, on July 16. H. B. McDermott, foreman miner, of the Bureau, is directing the instruction of the Bingham mine team of Utah Copper, and that of Utah-Delaware; C. O'Connell, first-aid miner, is training the two teams at the Magna and Arthur mills of Utah Copper. The car will leave Bingham on July 28 to give training to teams at Great Falls and Anaconda, Mont., and to those in the Cœur d'Alenes.

An elimination first-aid contest will be held by Utah Copper on July 26, when the three teams representing the Bingham mine, Magna mill, and Arthur mill of the company will compete to determine which team will represent the company at Butte.

Opp Gold Mine Purchased

Eugene Childers and C. C. Clark, of Medford, Ore., have purchased the Opp gold mine, at Jacksonville, Ore., and have reopened the property, which totals 373 acres in extent. They plan re-equipping it with a modern 100-ton mill. At present it has a small cyanide mill.

Herbert Hoover greets mining men at Ogden, Utah, while en route to Palo Alto

Utah Mining Men Greet Hoover

AMONG the various occasions when mining men had an opportunity to extend their greetings to Herbert Hoover, on his journey to Palo Alto, Calif., was a stop at Ogden, Utah, on July 19, of over thirty minutes made by the "Limited" bearing the Presidential candidate west to his home near Stanford University, where both Mr. and Mrs. Hoover were educated.

An enthusiastic crowd welcomed Mr. Hoover at Ogden, and following a short address, in which he expressed his satisfaction on being back among his friends in the West, he shook hands with many of those present. Included among those greeting Mr. Hoover were Louis S. Cates, vice-president and general manager of the Utah Copper Company, and president of the Utah Hoover-for-President Club; and, J. C. Dick, consulting mining engineer of Salt Lake City, and secretary of the Utah Hoover-for-President Club.

Option on Rufus-Argenta Mines Is Dropped

The Daly-Gerard interests, of New York, have failed to exercise their option on Rufus-Argenta Mines, which owns a large consolidation of claims at the head of Bear River, in the Portland Canal mining district, British Columbia. In the early part of the year, the New York syndicate acquired the option of 1,600,000 shares of Rufus-Argenta Mines, subject to the approval of its engineers after examination. It undertook to spend not less than $10,000 monthly on the exploration, development, and equipment of the property and it was to have been allotted shares at a valuation of $1 par for the money as it was spent. The ore contained copper, lead, zinc, gold and silver. An 800-ft. tunnel was started in 1925.

International Industrial Relations Discussed

That mass production is insecure for both labor and capital because of its dependence upon wide markets, and that social research and scientific management under the joint auspices of labor and employers are needed to give stability to industry and to protect wage earners against those effects of mechanization which are detrimental, was pointed out by speakers from the United States, Great Britain, Germany and other countries at the congress of the International Industrial Relations Association (for the study and promotion of satisfactory human relations and conditions in industry), which recently completed five days' discussion of the subject, Fundamental Human Relationships in Industry, at Cambridge, England.

The congress was attended by personnel managers and welfare workers, employers, representatives of labor, factory inspectors, and research workers from twenty countries.

Fire Destroys Helena Office Buildings on July 16

On July 16, a fire destroyed three buildings on the west side of Main St., Helena, Mont., which contained the offices of several mining companies and mining men. They were the Granite, Bailey, and Gold blocks, the principal office buildings in the city. Among the firms and individuals suffering losses were the Intermountain Engineering Development Company, Rosenfield Brothers, George B. Conway, C. R. Brazier and L. S. Ropes.

Mountain View, in Alaska, Strikes Gold-Silver Ore

Sitka, Forty-Mile, and Hyder Districts Active—Six Dredging Plants Operating at Fairbanks

AT THE Mountain View property, near Hyder, Alaska, the northeast drift has encountered high-grade ore at a distance of about 2,300 ft. from the portal of the main tunnel. This orebody is the same one found in the No. 1 level. The property is developed by about 3,600 ft. of underground workings and is equipped with a hydro-electric plant and an aërial tramway, 4,000 ft. long. The Lucky Boy Extension, Virginia, Cantu, and Hyder Lead properties, on Texas Creek, are also active in this district. The ore near Hyder is chiefly silver-gold.

Considerable new development work is going on near Sitka. Falcon Mining is at work on its nine claims on Chichagof Island, near Falcon Arm. This is also a gold-silver property. The Ostland-Preble syndicate, controlled by Portland interests, is developing its recently acquired holdings at the head of Silver Bay. They total 34 claims. Apex-El Nido, a gold producer on Chichagof Island, is being closed temporarily for reorganization. There is a ten-stamp mill on the property, erected in 1923, and other equipment, including an aërial tram.

On Forty-Mile, the Cowden company is employing 25 to 30 men in hydraulicking operations. Peters Creek, in the Talkeetna district, is being investigated for dredging possibilities.

A gasoline dredge is working on Chatham Creek, at Fairbanks, and the Whitworth dredge, on Fish Creek, will soon be at work. In addition, the Aarons company has one dredge operating and is preparing another for work on Fairbanks Creek. These dredges, together with the two operated by Fairbanks Exploration, will make a total of six dredges at work at Fairbanks, with two others operating in the vicinity. Cleary Hill Alaska is sinking a two-compartment shaft on the Rhoads-Hall gold-quartz property, near Fairbanks. It was previously developed by tunnels.

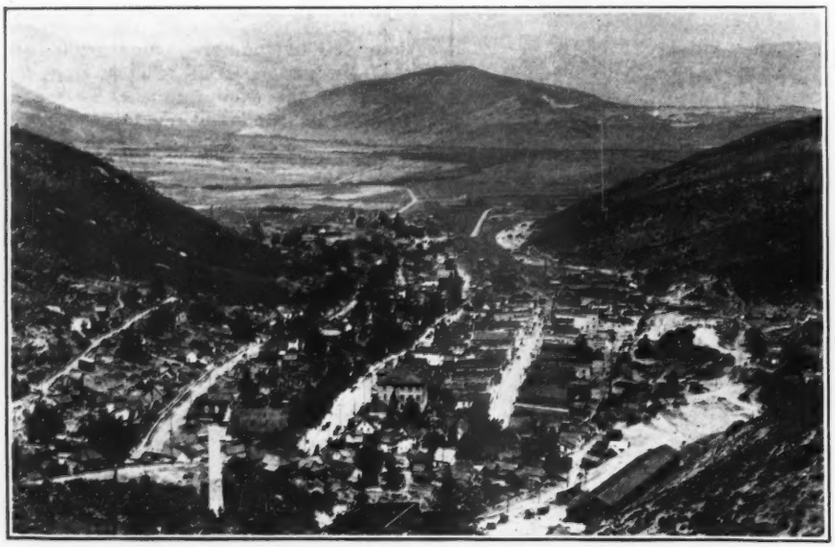
The ground on which a dredge was recently installed at Independence Creek has proved too shallow for dredging, and a hydraulic plant is being substituted by the Berry interests.

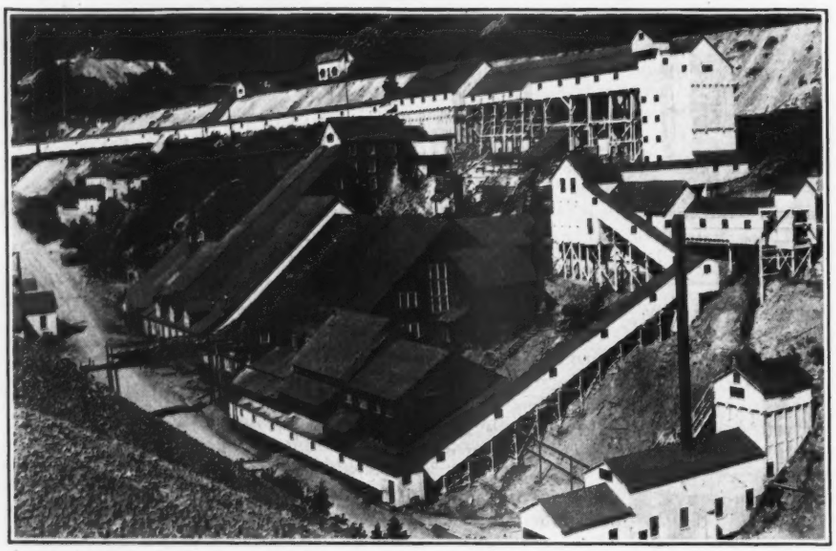
Sudbury Basin Developing Lead Mine Near Lake Huron

Sudbury Basin Mines is preparing for active development of a lead property at White River, on the north shore of Lake Huron, in addition to its mine at Sudbury. The lead outcrops on the top of a mountain, and it is planned to drive a tunnel at the base to tap the deposit. The plant on the property consists of an Ingersoll-Rand three-drill compressor, pipes, and other equipment sufficient to do about 1,400 ft. of lateral work.

TWO NEW PRODUCERS

Recent Development and Capacity of Important





SHIPMENTS from the mines in the Park City district of Utah during the first six months of 1928 show little change from those of the corresponding period of 1927, even though the names of two new companies—New Quincy and Star of Utah—appear in the list of shippers this year. Tonnage of crude ore delivered to the smelters declined 5 per cent; output of lead concentrates increased 5½ per cent; and production of zinc concentrates declined 2½ per cent. According to statistics, courteously furnished to *Engineering and Mining Journal* by the various companies operating in the district, 136,033 tons of crude ore, 26,868 tons of lead concentrates, and 23,316 tons of zinc concentrates were shipped the first half of 1928; figures for the same months of 1927 were 142,887 tons of crude ore, 25,421 tons of lead concentrates, and 23,926 tons of zinc concentrates.

THE largest producer in the district, Park Utah Consolidated, this year reduced its shipments of crude ore 10 per cent, of lead concentrates 1 per cent, and of zinc concentrates 8½ per cent, as compared with those for 1927. Shipments were made as follows: (first half of 1928) 116,426 tons of crude ore, 13,736 tons lead concentrates, and 17,248 tons zinc concentrates; (first half of 1927) 129,658 tons of crude ore, 13,871 tons lead concentrates, and 18,866 tons zinc concentrates. During the current year the company has given considerable attention to shaft sinking and the cutting of pump stations on the 1,800 level of the Park Utah unit, where new pumping equipment installed recently is handling a flow of 3,500 gal. a minute. A new tipple was placed in operation at the Keetley, Utah, portal of the Ontario drain tunnel, and has enabled the company to increase markedly the efficiency of ore loading there.

PRODUCTION of Silver King Coalition showed a fair increase over the first six months of 1927; crude ore shipments were 25 per cent greater, lead concentrates 10½ per cent, and zinc concentrates 16 per cent. Shipments were made as follows: (first half of 1928) 14,964 tons of crude ore, 12,772 tons lead concentrates, and 5,873 tons zinc concentrates; (first half of 1927) 11,949 tons of crude ore, 11,550 tons lead concentrates, and 5,060 tons zinc concentrates. Remodeling of the mill, whereby the capacity was increased from 600 to

Above—Park City, Utah, as seen from a vantage point on the mountainside.
Middle—Daly Judge mill of Park Utah Consolidated Mines.
Below—Surface plant of Park-Galena Mining Company.

IN PARK CITY GROUP

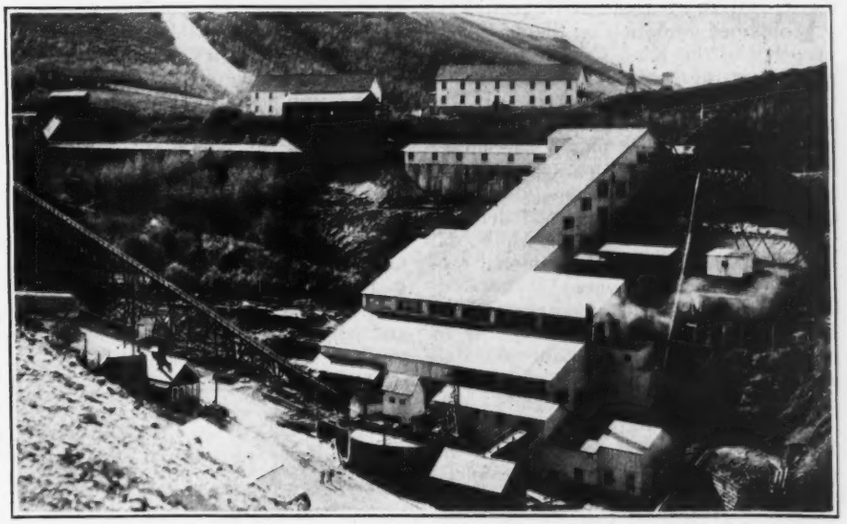
Modern Equipment Increase Utah Lead-Zinc District

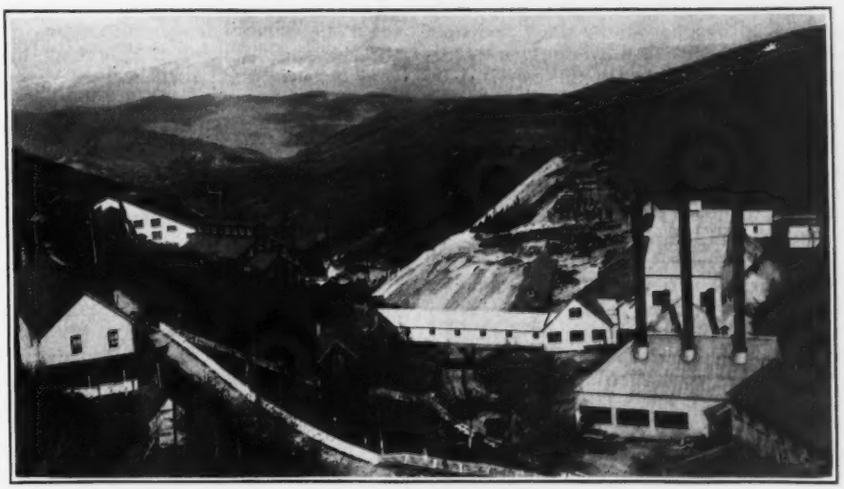
1,000 tons daily, was one of the most important developments at the company's property this year.

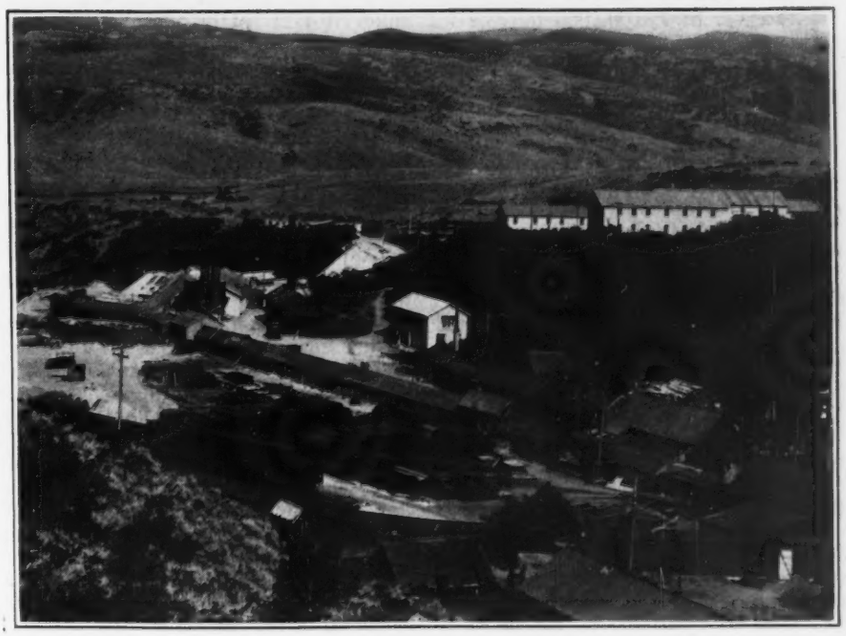
PARK GALENA shipped 118 tons of crude ore, 360 tons of lead concentrates, and 195 tons of zinc concentrates this year, as against 1,280 tons of crude ore during the first half of 1927. The new 100-ton mill of the company was completed on Jan. 1, 1928, and given a trial run from Jan. 15 to Feb. 15. It was then closed down to make changes in the fine-grinding department, following which it was restarted on Feb. 27. Operations were continuous throughout March, excellent lead recoveries being effected, but only a 70 per cent zinc recovery was obtained. It was decided to close down on April 1, so that extra thickeners might be added in the zinc circuit. While these installations were being made, the main shaft was extended 100 ft. to the 500-ft. point. The remodeled mill, which resumed operations July 16, is equipped with sixteen Fagergren flotation machines, the lead and zinc sections each consisting of six rougher and two cleaner machines. During the last three months, considerable development work has been done at the property. Seven headings are being worked, two on the 200 level, one on the 300 level, two on the 400 level, and two on the 500 level. Ore mined is coming from twelve stopes on the same levels.

SHIPMENTS by New Quincy, which began March 10 and totaled 4,404 tons for the first half of 1928, increased steadily during the last four months, until at the close of the period the property was shipping at the rate of 60 tons a day. Starting with an operating crew of eight men, this force has been gradually built up to fifty men. Development work has been expanded rapidly along with actual mining operations, and the ore vein has been followed along the strike for a distance of 500 ft. At present the face of the main drift on the 1,500 level is entirely in ore, and the prospects of the company are brighter than at any time in the past.

STAR of Utah shipments, totaling 121 tons, were begun early in June, and have continued steadily. Operations have been largely of a developmental nature in accordance with the company's plans to open up the various productive fissures on the property.







Above—Mill of Silver King Coalition Mines.

Middle—Shaft house, office building and milling plant at Silver King.

Below—Keetley portal of the Ontario drain tunnel of Park Utah.

Kino Copper, Near Nogales, Is Optioned by New Yorkers

Optionees Have Till December to Decide on Purchase—Sale of Louis d'Or Mine Reported

A GROUP of New York men have obtained an option on the 2,540-acre property of the Kino Copper Company, situated in the Patagonia Mountains, 12 miles east of Nogales, Ariz. If the property is purchased, $750,000 cash will be paid in December plus a percentage of the stock of the company which will be organized. In the meanwhile, $100,000 will be spent on diamond drilling, which is to start at once. M. F. H. Koch, of New York, is the personal representative of the optionees.

Kino Copper was incorporated in May, 1925, to consolidate a number of properties, the most important of which is probably the Four Metals mine. The capitalization of the company was 1,000,000 shares of $1 par. Most of the development work has been done at the Four Metals mine by crosscut tunnels, connected by an upraise. The adjoining Bennett and Buena Vista mines, also controlled by Kino Copper, have been developed by one 200-ft. shaft and four tunnels. Allen T. Bird was president and general manager of the company.

The property of Louis D'Or Mining & Milling, adjoining Inspiration Consolidated at Miami, Ariz., was sold at a public sale at the courthouse in Globe on July 17 to satisfy notes held against the company. The noteholders' committee was composed of George M. Eggleston, Orin P. Peterson, and L. W. Whitmer. The transaction was handled by Attorney Cullen A. Little, of Globe and C. S. Andrews, vice-president and treasurer of the company. Louis D'Or Mining was capitalized at $40,000,000, in shares of $1 par. The property consisted of a total of 147 claims, equaling 2,800 acres. It was developed by several shafts and tunnels. At one time the company gave an official estimate of ore reserves of 150,000,000 tons of 1.2 per cent copper.

Consolidated Lead & Zinc Buys Domada Mining

CONSOLIDATED Lead & Zinc has purchased the properties of the Domada Mining Company, in the Tri-State district, for a consideration said to exceed $400,000, according to F. W. Bendelari, president of the Consolidated company. The properties of the Domada company included the Domada, Jack and Jill, and Kitty mines and the Mary M. flotation plant.

A large tonnage of high-grade ore is reported still remaining in the Domada mine by the engineers who examined the property for Consolidated. It is situated south of Cardin, and has for some time been one of the most productive mines in the district. The lease, consisting of 40 acres, adjoins the Baby Jim mine of Consolidated, and as it is under the same fee ownership, the two mines can eventually be joined.

Domada recently purchased the Kitty mine for $125,000 and joined it to the Jack and Jill. The Jack and Jill mill was destroyed by fire soon after the transaction, but as it was the intention of the company to send the production of both mines to the Kitty mill, it was not rebuilt. Slimes and tailings from the Kitty mill were treated at the Mary M. flotation plant, built by Charles Neal, manager of the Domada company. It was placed in operation only a few months ago.

During the year, Domada has produced about 5,000 tons of lead and zinc. This production, added to that of the Consolidated, will make the latter company a larger producer than Eagle-Picher Lead, of which it is a subsidiary, and will put it in third place among the producers of the district.

McCoy Nevada Formed to Work Claims in Lander County, Nev.

AFTER securing favorable reports from several engineers who examined and sampled the McCoy and Iron groups of claims in the McCoy mining district, situated 26 miles southwest of Battle Mountain, Nev., a group of Chicago men, headed by Harry W. Boyer, of Los Angeles, have started development of the claims and plan a thorough exploration of the ground. The company is called McCoy Nevada Gold Mines.

It is considered likely that the ore zone is a continuation of the belt on which the Galena district, 10 miles north, is situated. The Galena district is still producing spasmodically, although its active days are past.

The property consists of thirteen full lode claims, in addition to valuable water rights to the flow from springs at the base of the mountain, one and a half miles distant. Orebodies occur along the contact of limestone beds with eruptive rocks, including a typical diorite, and away from it but paralleling its course in the diorite. Several bodies of what is expected to be commercial ore are exposed, according to B. P. Howell, engineer in charge of development.

At the time of the camp's discovery, ten or twelve years ago, several leases produced shipping ore, which was sent to the Salt Lake smelters. However, the greatest depth attained by workers at that time was only 55 ft. Ore is exposed at the bottom of this working, carrying gold and some silver. According to W. P. Catlin, geologist for the Southern Pacific Railroad, he obtained an average of more than $12 a ton across a width of 26 ft.

H. D. Brown, of Chicago, is president of the new company. F. M. Lovell and H. W. Boyer are members of the board of directors. J. H. McCoy, of Battle Mountain, is superintendent. Battle Mountain is the company's post office.

Unwatering Phoenix Mine, in Gilpin County, Colo.

Quartz Hill Undertakes Reopening Project—Drift Being Driven to Mary Ann from Jo Dandy

ON JULY 14, the bottom of the shaft in the old Phoenix mine, Gilpin County, Colo., which has been flooded for several years, was tapped by an upraise of 202 ft. The opening in the shaft was made by a diamond drill, 2½ in. in diameter. It will require some months to complete the unwatering, undertaken by the Quartz Hill Holding Company, under the direction of Harold Thorne, president. The project includes, in addition to the Phoenix, the Ophir, Kansas, and California-Pozo mines. When the water is out of the mines, access to them will be provided by the Argo tunnel. Ore will be sent to the mill at the Idaho Springs entrance to the tunnel, which is almost 5 miles long.

The Argo mill was recently remodeled, under the direction of James N. Flood. A copper-lead separation will be effected, with rejection of pyrite and a little sphalerite.

At Cripple Creek, a drift is being driven from the third level of the Jo Dandy mine toward the Mary Ann. The Jo Dandy was recently reopened by Red Raven Gold. Alexander Walker is superintendent. Labor conditions in the Cripple Creek district have been characterized as good, according to a report of the U. S. Department of Labor, issued early this month.

Judge J. C. Wiley, who is operating the Little Annie mine, near Summitville, Colo., under lease, has denied reports that the property will be sold. It is the property of the Barnsdall and Renolds-Morse estates.

The recent purchase of the Matchless mine by the Shorego Mining Corporation is said to have been effected by J. K. Mullen, flour-mill owner of Denver, for the purpose of returning the property to Mrs. Elizabeth Tabor, widow of H. A. W. Tabor, U. S. Senator from Colorado. The mine had been involved in litigation for some time.

Sodium Mine at Camp Verde Closes Down Temporarily

SODIUM PRODUCTS, which operates at Camp Verde, Ariz., has temporarily suspended production, because its ore bins are full. As soon as material on hand is shipped, the company will resume production. This will probably be within the next six weeks. The plans of the company at present call for removal of the overburden in the pit and installation of larger machinery in the mill to take care of contracts, which have been made for Jan. 1, 1929. The new contract made with the International Paper Company calls for 45,000 tons of sodium sulphate a year for a period of five years. Dean Butler of the University of Arizona recently completed an examination of the property.

London Letter

By W. A. Doman
Special Correspondent

Shamva Mines Report Shows the Property Still in Good Condition

London, July 11, 1928.—The annual report of the Shamva Mines, in Rhodesia, again discloses that a remarkable property is being worked. Ore reserves still exceed 1,000,000 tons, and the prospect of finding additional ore is favorable. The gold content ranges from 2.6 dwt. to 4.13 dwt. per ton. About 70 per cent of the ore averages a little more than 12s. a ton, and the balance is estimated at 17s. 3d. In treatment about 90 per cent of the gold content is recovered. Total working costs are 9s. 6d., including development redemption at 1s. 3d.

Sub Nigel, one of the Rand mines, has been the sport of unfavorable development rumors which have forced down the price. An official cable dispatch from Johannesburg denies that there is anything amiss at the mine. Nevertheless, the selling comes from South Africa.

APART from the two companies mentioned, interest has centered upon manganese and asbestos. The position of the former is somewhat obscure. An expert sent out from England to the Transvaal was not, it is said, too favorably received, as local people preferred a local expert to report upon various properties. It is possible that the attitude adopted was due more to nationality than anything else. The Postmasburg deposits are to be floated with a capital of £1,000,000, including £800,000 for working capital. Criticism of the size of the capital has been heard. Professor Richter has reported favorably on the field.

Technical people are astonished at the rapidity with which asbestos is discovered and estimates as to grade are made. In Southern Rhodesia, two companies have recently come before the public—Mapeke Asbestos Mines and Mashaba Asbestos. The former was originally Mapeke Mines; the word asbestos was incorporated to identify the name of the company with its special object of asbestos mining. Mapeke and Mashaba are described as large, open quarries. An Australian asbestos company in West Pilbara has also made its appearance.

Mond Nickel, for the year ended with April, earned a gross income of £776,830, against £528,730, this being presumably due to the extended use of nickel alloys. Much depends now upon the Frood mine, which is expected to produce in 1930. For equipping it £600,000 in new shares of 10s. each are to be created, and the existing shares are also to be divided into the same denomination.

Tetiuhe Mining Corporation (Siberia) shows in the report for fifteen months to Sept. 30 last a debit balance of £16,826, after providing for debenture interest and depreciation. Concentrates sold realized £106,948, but costs were £107,485. As with other companies operating under the Soviets, the depreciation of the ruble is a drawback. Wages have increased and the cost of stores and materials locally has risen. Mine reserves were estimated at 966,000 metric tons of sulphide ore, averaging 8.1 oz. silver, 10.6 per cent lead, and 13.7 per cent zinc. As the result of modification of the flotation process, 80 per cent of lead and zinc was being extracted at the end of the period.

Mexico City Letter

By W. L. Vail
Special Correspondent

Drought in Part of Chihuahua Affecting Power Supply for Mines

Mexico City, July 16, 1928.—Concern is felt in certain sections of Chihuahua because of the unusual drought. The big Boquillas dam, which furnishes power to the Chihuahua, Parral, Santa Eulalia, and other important mining districts of the state, is reported to have barely sufficient water for a few months, and unless heavy rains occur soon, a number of big plants will be without power. The general situation in the state is reported as quite satisfactory.

San Juan Taviche Mining Company has made application to close because of the unprofitable operations under present conditions, with particular reference to metal prices. This mine employs a large number of workmen, and the government has appointed a commission to investigate the situation for the purpose of finding ways and means to continue operations.

REPORTS from the Santa Maria de La Paz mine, at Matchuala, San Luis Potosi, state that a large body of high-grade ore was struck on the 600 level. June output of silver from the property was 8,347 kilos. The company is controlled by local interests. Ore is being shipped to the A. S. & R. smelters at Matehuala and Monterey.

The Chontalpan y Anexas company has acquired several properties adjoining its mine at Chontalpan, Guerrero, and is preparing to increase its output. The property is equipped with a new 120-ton flotation plant.

During the general assembly of the Confederated Chambers of Commerce of Mexico, which will be held next week, a study will be made of the present income tax law with special reference to the percentage now allowed by the law on the deterioration of machinery and equipment. The present maximum is held to be insufficient by many of the mining companies.

Toronto Letter

By Our Special Correspondent for Northern Ontario

J. Y. Murdoch Issues Report on Strike at 975 Level in Noranda Mine

Toronto, July 21, 1928.—President J. Y. Murdoch of Noranda Mines has made a statement in regard to the recent discoveries at the 975 level of the mine, in the Rouyn district, which have sent the value of the stock up to the present quotation of $57 a share. A drift has been run for 131 ft. on the 975 level, and it has been in ore, except for a 10-ft. tongue, all the way. Diamond-drill holes, driven west of the face, have indicated high-grade ore in that direction for 418 ft. Copper content decreased somewhat, but gold content increased with distance. A drill hole has been driven 150 ft. to the east, with 130 ft. in ore. This drill hole recently encountered diabase formation, but it is being continued, as high-grade occurs on both sides of this dike on the upper levels. On the 850 level, where a station has been cut, a drift has been driven north for 61 ft., of which 49 ft. showed high-grade ore. Although the face was still in ore, this drift was discontinued temporarily to allow a station to be cut on the 725 level. This station has been completed, and the first work on this level done south of the shaft. A crosscut driven north on this level cut the "H" orebody 25 ft. from the shaft.

THE smelter is reported to be running smoothly, turning out about 70 to 80 tons of blister a day, of which more than half is being sent to Hamburg, Germany. The remainder is being sent to New York. The possibility of sinking a new shaft to a depth of 1,000 ft. is being considered.

D. B. Hanna, president of Kirkland Lake Gold, says that the crosscut on the 2,850 level has struck a vein, 16 ft. in width. The ore is in the porphyry formation, which is expected to extend to the Teck-Hughes boundary, 200 ft. away. The winze has been carried below the 2,850 level. A station will be cut when the 2,975 level is reached. The mill is treating 150 tons daily, with mill heads averaging about $17. Its capacity will soon be increased to 200 tons.

The two shafts at Sherritt-Gordon, in northern Manitoba, are being sunk at a rate of about 200 ft. a month. Stations have been cut at two levels on the east shaft, which is now down about 280 ft., and drifting is to begin immediately. The west shaft, which is situated about 7,000 ft. from the east, will be continued to 400 ft. before any lateral work is attempted. About 8 miles further to the east, the company has staked a claim, which is said to show a comparatively high-grade copper-lead-zinc ore. A diamond drill has been moved out to the property and is now working.

BOOK REVIEWS

Earthquake Prophecies Refuted

SOUTHERN CALIFORNIA AND LOS ANGELES EARTHQUAKES. By R. T. Hill, late geologist U. S. Geological Survey. Southern California Academy of Sciences, Los Angeles, Calif. Cloth, 6 x 8 in., illustrated, 232 pages. Price $5.

EARLY in 1926, Prof. Bailey Willis, of Stanford University, read a paper entitled "A Rational Basis of Earthquake Insurance" at the annual meeting of the National Board of Fire Underwriters. In this he anticipated a serious and far-reaching quake in Southern California, which might come "soon or within a decade, or not until after a decade"—which is rather inconclusive as to exact date, but includes most dates that one can think of offhand. An immediate result of this statement was the raising of earthquake insurance rates in Los Angeles from 100 per cent to as high as 220 per cent.

The book under review is published to counteract the effect of Professor Willis's statement. Mr. Hill claims that the indirect effect of the prediction will be permanently damaging to Southern California, and states, "It is my object in this report to refute his inconsiderate, inaccurate, and damaging prophecies. I will show that there is absolutely no foundation for the prediction, either in the laws of nature or the scientific data of this region. And above all I will establish the fact that the whole structure of his prediction is built upon premises which have been disproved and retracted."

Mr. Hill contends that the Willis statements are postulated on triangulation point surveys secured by the U. S. Coast and Geodetic Survey which indicated that the mountains of California on each side of the San Andreas Rift were sliding past one another at a rate of 24 ft. every 30 years. Mr. Hill bases his rebuttal on the published results of recent recomputations, which amount to virtual retractions of the original data, and he proceeds in a logical way to build up his case around this point. The book is well illustrated, and is worth reading if one is interested in the subject. HOMAR L. JOHNSON.

CLAY INDUSTRIES OF CALIFORNIA. By W. F. Dietrich. Bulletin of the Division of Mines and Mining, Department of Natural Resources, California.

AN EXCELLENT SUMMATION of the clays and ceramic industry of California has been given by Mr. Dietrich in this bulletin. The status of this industry, which has been developed for more than 50 years, is splendid. Many clay deposits of various kinds have been made available, but the resources of the state have not been exhausted, and future supplies of clays are reasonably assured. Importation of certain clays and materials is necessary, but this does not impose any special hardship. The industry is concentrating into larger units, which is to be expected, as the larger unit is more favorable for the development of mechanical equipment and can afford a more thoroughly organized sales and engineering staff. A Clay Products Institute has been formed, and through it may be expected a better dissemination of technical information, control of business practices, co-operative efficiency, and a consistent growth of the industry generally.

At present the market for clay products upon the Pacific Coast is abundantly supplied, and new ceramic enterprises, except where they supply products different from those now being manufactured, would only add to the stress of competition, which is keen enough now. The situation is favorable for the growth of new business as population increases, but such demands can be amply supplied by the manufacturing facilities now available. Consolidation of smaller manufacturers will naturally take place. Under such circumstances the improvement of existing establishments by the introduction of more mechanical equipment appears to be the direction in which the ceramic industry is trending. G. J. YOUNG.

YEAR BOOK, AMERICAN ENGINEERING STANDARDS COMMITTEE, 1928. Published by the American Engineering Standards Committee, 29 West 39th St., New York City. Paper, 87 pages, 7½x10½ in.

IN ITS Year Book the American Engineering Standards Committee reviews briefly the work accomplished in 1928 and explains its method of working and its use of available facilities. There are listed in the book all the projects that on April 15, 1928, had an official status before the committee, including standards that have been approved, publications available, co-operating organizations, members and sustaining members.

GEOLOGY OF PETROLEUM AND NATURAL GAS. By Ernest R. Lilley. D. Van Nostrand Company, 8 Warren St., New York. Pages 524. Price, $6.

ANTICIPATING that some may ask "Why another book on petroleum?" Professor Lilley says that it is necessary to stop from time to time and summarize the data that have become available: the mass of descriptive detail has reached such proportions that the individual actively practicing the profession of petroleum geology cannot keep up with its literature. He has therefore produced a single volume stating briefly the principles of the science and giving examples illustrating their application. The reason for the book's existence being thus set forth and found acceptable, it remains to discover how Dr. Lilley has succeeded in carrying out his intention. The author's experience in the field and as a lecturer to business men on the practical aspects of the petroleum industry serves him in good stead. He writes clearly and concisely. He develops his subject logically. His language is simple and his illustrations are ample. Engineers, geologists, and students will find the book useful and instructive.

MINING PRACTICE—The *Mining and Industrial Magazine of South Africa* of June 13, 1928, contains a short article describing the latest mining practice at the City Deep mine.

GEOPHYSICS—A translation from the Russian of certain papers on measurements of terrestrial radioactivity is contained in Circular No. 6072, issued by the Bureau of Mines. The authors are L. N. Bogoiavlensky, A. A. Lomakin, and A. Cherepenikov. The first two are also authors of a paper entitled "Experiments on Highly Penetrating Radiations From the Earth." Mr. Bogoiavlensky's paper is entitled "Radiometric Exploration of Oil Deposits." A supplementary chapter on "Radioactive Substances and Methods for Locating Them," by F. W. Lee, is added. The 27-page bulletin concludes with a two-page bibliography.

METEORITES—George P. Merrill, head curator of geology at the U. S. National Museum, has written a paper entitled "Concerning the Origin of the Metal in Meteorites" (No. 2742, Proceedings of the U. S. National Museum).

ZINC INSTITUTE — The May-June issue of *"Zn,"* the official bulletin of the American Zinc Institute, contains a report of the proceedings of the tenth annual meeting at St. Louis last April.

CARTELS — The "International Cartel Movement" is the subject of a paper by Louis Domeratzky, chief of the division of regional information of the Bureau of Foreign and Domestic Commerce, at Washington. The pamphlet is known as Trade Information Bulletin No. 556, and contains sixty-one pages.

Among the recent reports issued by the U. S. Bureau of Mines are the following:

Serial No. 2865A — "Rock-Strata Gases in the Cripple Creek District and Their Effect on Mining," by E. H. Denny, K. L. Marshall, and A. C. Fieldner.

Serial No. 2877—"Flotation of Fluorspar Ores for Acid Spar," by Will H. Coghill and O. W. Greenam.

Serial No. 2878 — "Copper Milling Research in Michigan," by A. W. Fahrenwald.

Circular No. 6073 — "Fires and Fire Prevention in Lake Superior Mines," by F. C. Gregory.

Personal Notes

EDWIN A. MCKANNA, geologist, of Berkeley, Calif., was a recent visitor to New York.

THOMAS T. READ, assistant secretary of the A.I.M.E., is on a trip to the Pacific Coast and the Northwest.

A. W. ALLEN is in California. He will return to New York early in August, via Denver and Salt Lake City.

MATTHEW VAN SICLEN, consulting mining engineer of Washington, D. C., is in the Tri-State district on professional business.

Major L. A. POLLAK, manager of the Anglo-American Corporation of South Africa, Ltd., recently returned to Johannesburg from a visit to Broken Hill, Rhodesia.

H. O. HOWARD, of Los Angeles, Calif., has been in New York in connection with the sale of the Cleveland mine, in the Bully Choop district, Trinity County, Calif.

W. E. SIMPSON has been appointed consulting engineer for the Majestic Gold Mines, Ltd., the property of which is on West River, in the Sudbury district of Ontario.

THOMAS H. MILLER, of Laramie, Wyo., has been appointed assistant to CHARLES W. HENDERSON, engineer in charge of the Denver office of the U. S. Bureau of Mines.

HUGH D. MISER and MARCUS GOLDMAN, of the U. S. Geological Survey, have been examining the manganese deposits in Cedar Creek Valley, Frederick and Shenandoah counties, Va.

R. F. MCELVENNY, manager of the Western department of American Smelting & Refining, returned to Salt Lake City on July 23 after making a business trip of a week to Colorado and Texas.

D. F. WARDWELL, deputy supervisor of the Conservation Branch of the U. S. Geological Survey, with headquarters at Casper, Wyo., has resigned to enter the aviation industry at Casper.

Lieutenant Colonel J. P. GRENFELL has returned to England after a visit to the Transvaal, on which he inspected the properties of the Messina Development Company, of which he is chairman of the board.

A. H. MEANS, mining geologist and engineer, of American Smelting & Refining, and Captain of Field Artillery, O. R. C., reported on July 23 at Fort D. A. Russell, Wyo., for two weeks' training.

Dr. J. S. DELURY, of Saskatoon, Saskatchewan, has been appointed Commissioner of Mines for Manitoba and professor of geology and mineralogy at the University of Manitoba. He succeeds Dr. R. C. WALLACE.

S. M. SOUPCOFF, mining engineer of the staff of American Smelting & Refining, returned to his Salt Lake headquarters on July 19 from an inspection trip of three weeks to properties in Nevada.

CHARLES W. DOW, of Grass Valley, Calif., has been in New York on business connected with the financing of the Western Mines Consolidated, Inc. The company controls a group of old properties in the Nevada City district.

JACOB E. BAMBERGER

J. M. HOLT, who has been working a property on the Island of Marinduque, in the Philippine Islands, is in Denver in connection with the purchase of machinery for milling operations. He brought five tons of ore with him to be tested.

WILLIAM MURDOCK, formerly manager of the Lebel Oro mine, at Kirkland Lake, has been appointed manager of Creighton Fairbanks Mines, Ltd., with property in the Sudbury district of northern Ontario. He succeeds J. L. DICKSON.

ROBERT E. TALLY, general manager of United Verde Copper, has been elected president of the Missoula (Mont.) Public Service Company and the Western Lumber Company. Both of these enterprises are owned by the W. A. Clark interests.

DUNCAN MACVICHIE, consulting mining engineer, of Salt Lake City, and managing director of the Big Missouri Mining Company, returned to his Salt Lake headquarters on July 15 from a three weeks' inspection trip to the company's property, which is situated in the Portland Canal district of British Columbia.

B. L. SACKETT, general superintendent, International Smelting Company, and Mrs. Sackett, left Salt Lake City last week for a month's trip to Sitka and Juneau, Alaska. They will visit George A. Parks, Governor of Alaska, who was a classmate of Mr. Sackett's at the Colorado School of Mines.

ERIC C. BERRY, assistant refinery superintendent for the Burma Corporation, Ltd., at Namtu, North Shan States, Burma, has been in the United States and Canada for the last six weeks, visiting leading smelting and refining plants. He sailed for Liverpool on the "Duchess of Athol" on July 27 and will soon return to Burma.

GEORGE A. WEST, GEORGE R. FOX, and Prof. BAKER BROWNELL, of Northwestern University, are at the head of an expedition which will search Isle Royale, in Lake Superior, for traces of copper mining in prehistoric days. They believe that men mined copper there centuries before the Indians and the French settlers are known to have inhabited the island.

OBITUARY

HENRY J. NEWMEYER, Denver mining man, died at Denver on July 16. He was a native of Platteville, Wis., and came to Colorado in the 'seventies. He was responsible for the development of many mining properties in the Aspen, Leadville, and Idaho Springs districts.

JACOB E. BAMBERGER, one of the pioneers in the mining industry of Utah, died July 19, in Salt Lake City, as a result of injuries sustained last August in an automobile accident in France. He was 76 years old. Following the accident, he spent ten months convalescing in a Paris hospital. Attended by a physician and two nurses, he then journeyed back to his home in Salt Lake City, arriving there thirteen days prior to his death. Born in Eberstadt, Germany, on March 7, 1852, Mr. Bamberger came to this country when he was thirteen years old. Until 1875, when he settled in Salt Lake City, he was engaged in business pursuits; first, with his two brothers at Pleasant Hill, Mo., and subsequently at points along the Union Pacific railroad. From the time of his arrival in Utah, he was a close student of mining activity in the state. His early investments were successful, and within comparatively few years he was a prominent member of the industry. He was made president of the Centennial-Eureka Mining Company when it was organized, and retained this position until the property was acquired by the U. S. Smelting company. With H. G. McMillan, he formed the Bamberger-McMillan Company, which represented the Philadelphia Smelting Company at first, and later the American Smelting & Refining Company. In 1900 he and associates purchased control of the Daly-West Mining Company, Mr. Bamberger being elected president of the company, and retaining this position until 1913. He was also president of the Ontario Silver Mining Company, president of the Daly Mining Company from 1906 to 1912, and a director of the Braden Copper Company, in which he held a substantial interest. Mr. Bamberger was survived by his widow, three sons, and a daughter.

MARKET AND FINANCIAL NEWS

Lead Industry Follows Copper and Zinc in Forming an Institute

AN ASSOCIATION of lead-mining, smelting, refining and manufacturing companies is being formed, and, according to present plans, should be formally launched in the fall. Although no name has been given definitely to the organization, it will probably be known as the Lead Industries Association. Some of the larger lead mining, smelting, refining, and fabricating companies in North America have already signified their intention to become members in the proposed association. These include the American Metal Company, American Smelting & Refining Company, Bunker Hill & Sullivan Mining & Concentrating Company, Consolidated Mining and Smelting Company of Canada, Ltd., Eagle-Picher Lead Company, National Lead Company, St. Joseph Lead Company, United Metals Selling Company (Anaconda), and the U. S. Smelting, Refining & Mining Company. Many other mining companies and lead manufacturing companies are expected to become members.

The aims of the new association are not unlike those of the Copper and Brass Research Association, the Copper Institute, and the American Zinc Institute.

In general, the association intends to promote the common interests of those engaged in the production or consumption of lead. In detail, the proposed activities of the association embrace the dissemination of accurate information regarding the use of lead products; collection of statistical information relating to the lead industries and of current value to them; checking of substitution of other products for lead; and development of methods for the improvement of the welfare of those engaged in the lead industries. It is expected that the association ultimately will be strongly international in its membership and in the scope of its research and activities.

F. E. Wormser, formerly assistant editor of *Engineering and Mining Journal*, has provisionally been appointed secretary of the body.

STATISTICAL NOTES

BWANA M'KUBWA COPPER MINING CO., LTD., reports production of 69,820 tons of ore, averaging 3.36 per cent copper, at its Bwana mine, in northern Rhodesia, during the first quarter of 1928. Of this production 57,870 tons was treated in the leaching plant, yielding 2,022 tons of black copper oxide, analyzing 80.11 per cent copper. Recovery was 84.37 per cent of the copper in the ore. Because of repair to the reverberatory furnace plant, refining operations were restricted, shipment of best selected copper amounting to only 892 tons as production during quarter.

DOME MINES, LTD., milled 272,700 tons of ore during the first half of 1928. Gross recovery amounted to $6.842 per ton, or a total of $1,865,756. Net earnings before depletion or depreciation totaled $869,208, after crediting miscellaneous income for the period.

TRI-STATE ZINC AND LEAD ORE PRODUCERS' ASSOCIATION reports the cost of producing 24,855 tons of concentrates as $39.16 per ton of concentrates in May, 1928. Distribution of costs is indicated in the accompanying table:

Operating Expenses	Cost per Ton of Ore Hoisted	Per Cent of Operating Cost	Cost per Ton of Concentrates	Per Cent of Total Cost
Labor	$0.9081	47.22	$13.4197	34.27
Supplies and repairs	.2637	13.71	3.8967	9.95
Liability insurance	.0604	3.14	.8921	2.28
Explosives	.1456	7.57	2.1519	5.50
Exploration and development	.0799	4.15	1.1804	3.01
Power, all classes	.1993	10.36	2.9458	7.52
Fire and tornado insurance	.0351	1.82	.5183	1.32
Management, office salaries and expenses	.1142	5.94	1.6873	4.31
Taxes (excluding Federal income tax)	.0157	0.82	.2315	0.59
Miscellaneous	.1014	5.27	1.4981	3.83
Total operating expenses	$1.9234	100.00	$28.4218	72.58
Amortization of capital cost of				
(a) Depletion	.....	3.7038	.....	.....
(b) Depreciation	.....	2.3563	.....	.....
Total	.....	.....	$6.0601	15.47
Royalty	.....	.....	4.6800	11.95
Total cost of production	.....	.....	$39.1619	100.00

United Verde Most Valuable Mine Property in Arizona

ARIZONA mining companies were assessed for 1928 taxation purposes recently by the state board of equalization. Based on the equalization board's figures, United Verde, at Jerome, is the most valuable mining property in the state, with the two branches of Phelps Dodge Corporation listed separately. Comparison of the figures for the current year are presented with those for 1927 in the following table:

	Total Assessed Value 1928	1927
Calumet & Arizona	$26,642,696	$21,057,122
Shattuck-Denn	5,221,150	1,717,990
Magma Copper	13,249,661	10,088,840
United Verde	28,721,188	27,729,342
New Cornelia	24,939,909	21,978,542
Miami Copper	13,835,800	13,698,102
Phelps Dodge, Morenci Branch	16,741,335	16,721,476
United Verde Extension	13,528,627	19,853,206
Old Dominion	4,093,523	5,913,645
Phelps Dodge, Copper Queen Branch	23,826,762	26,852,793
Inspiration Consolidated	25,040,981	24,946,042
Nevada Cons. Copper Co., Ray Mines	20,061,805	.....

Thus seven companies show increases in assessed valuation and four companies show declines.

Plans Formulated for European Mercury Cartel

ITALIAN MERCURY producers and the Spanish government have agreed to market and control jointly their production of quicksilver for a period of ten years. The terms of the agreement are said to provide for the institution of a sales office, handling the production of both Italy and Spain, to be set up in some European country not yet designated. Output allotments in proportion to mining capacities will be subdivided among the government-controlled Idria mines and the private operators, Monte Amiata, Siele, and minor companies.

It is stated that the first task to be undertaken will be to dispose of considerable stocks now existing in Italy and Spain which have been accumulated in the last year, when there was a heavy output and in Italy diminished exports. As the first measure, both Italian and Spanish outputs will be reduced. The Italian Superior Mining Council has approved the provisions of the agreement outlined, according to report.

TEXAS GULF SULPHUR COMPANY reports net earnings of $3,586,820 in the second quarter of 1928. Total surplus and reserve for depletion on June 30, 1928, was $12.538,122. A dividend totaling $2,540,000 was paid June 15.

Net Earnings of Cœur d'Alene Mines in 1927

NET PROFITS earned by mining companies in the Cœur d'Alene district, Idaho, in 1927, amounted to $7,057,489 and the gross value of ore produced was $23,327,860. These figures were obtained from sworn statements filed on May 1, 1928, as required by the Idaho law for determining the net profits of mining operations which are subject to taxation. In 1926 the net profits were $7,957,901 and the gross value was $24,630,201. The lower totals in 1927 are accounted for mainly by the lower metal prices prevailing. Following are the figures for 1927:

	Gross Value	Net Profit
Bunker Hill and Sullivan	$6,910,720	$2,632,936
Caledonia	28,035	8,465
Federal (Morning mine)	6,924,808	1,888,565
Federal (Frisco mine)	222,798	18,405
Federal (Blackhawk royalty)	.....	19,815
Hecla	4,730,122	2,028,600
Strattons	272,013	19,706
Sunshine	595,291	290,483
Callahan (Galena mine)	434,929	76,072
Gold Hunter	642,656	39,073
Savage and George lease	115,369	12,419
Sheridan lease	347,705	7,674
Hull lease	107,632	15,272
Totals	$21,332,085	$7,057,489

Net losses: Tamarack & Custer, gross value, $1,155,640; net loss, $38,727; Federal (Page mine), $803,542; loss, $22,239; Federal (Mace mine), $36,592; loss, $10,241. Total net loss, $71,208. Gross value of all ore produced, $23,327,860.

Canadian Production of Copper in 1927

STATISTICS on Canadian copper production in 1927, finally revised, as reported by the Dominion Bureau of Statistics, show a production in 1927 of 140,147,440 lb., valued at $17,195,487, compared with 133,094,942 lb., valued at $17,490,300, in 1926. This is an increase of 5 per cent in quantity and a decrease of 1.7 per cent in value.

During 1927 copper was produced in the provinces of Quebec, Ontario, and British Columbia. Quebec accounted for 2 per cent, Ontario, 32 per cent, and British Columbia, 66 per cent of the total. The smelter of the Horne Copper Corporation was started on Dec. 16, 1927, and will be the means of increasing the copper production from Quebec in 1928. Much development work was done during 1927 on the copper-zinc properties of northwestern Manitoba.

Production in 1927 included (a) 46,210,393 lb. contained in ores and concentrates exported and (b) 93,937,047 lb. of copper in blister copper made, in matte exported and in copper sulphate made during the year. The corresponding figures for 1926 were: (a) 43,597,943 lb., and (b) 89,496,999 lb.

Production of Copper in Canada, by Provinces

Province	1926 Pounds	1926 Value	1927 Pounds	1927 Value
Quebec	2,674,058	$368,886	3,119,848	$403,084
Ontario	41,312,867	4,828,964	45,341,295	4,946,533
British Columbia	89,108,017	12,292,450	91,686,297	11,845,870
Canada	133,094,942	$17,490,300	140,147,440	$17,195,487

Canadian Production of Nickel in 1927

FINALLY revised statistics of Canadian nickel production in 1927, as reported by the Dominion Bureau of Statistics, show an output of 66,798,717 lb., valued at $15,262,171, compared with 65,714,294 lb., worth $14,374,163, in 1926. These figures include the nickel in matte exported by the Mond Nickel Company, Ltd., and the International Nickel Company of Canada, Ltd., valued at 18c. per pound; refined and electrolytic nickel produced by the International Nickel Company, valued at the average price obtained for such products sold during the year; nickel in nickel oxide and nickel salts sold from Deloro and Port Colborne at its total selling value as oxide or salts; and nickel contained in speiss residues exported, valued at 18c. per pound.

Production in Canada and Exports of Nickel

	1926 Pounds	1926 Value	1927 Pounds	1927 Value
Production				
Nickel in matte and speiss exported (a)	34,028,211	$6,125,078	31,584,097	$5,685,138
Refined and electrolytic nickel produced	25,627,602	6,423,401	28,469,996	7,497,436
Nickel in oxides and salts sold	6,058,481	1,825,684	6,744,624	2,079,597
Totals	65,714,294	$14,374,163	66,798,717	$15,262,171
Exports				
Nickel, fine	24,698,400	$6,386,387	29,015,800	$7,896,211
Nickel contained in matte	39,177,400	6,074,497	36,458,800	5,784,623
Nickel oxide (b)	.....	.....	5,196,100	1,600,986
Totals	63,875,800	$12,460,884	.....	$15,281,820

(a) Nickel in matte and speiss exported valued at 18c. per pound.
(b) Nine months 1927.

SYLVANITE GOLD MINES, operating in the Kirkland Lake District of Ontario, mined 57,341 tons of ore during the year ended March 31, 1928. Recovery of bullion amounted to $609,181, or an average of $10.62 per ton. Metallurgical recovery averaged 94.4 per cent for the entire year and 94.8 per cent during the last six months of the year.

N'CHANGA COPPER MINES, LTD., has expended £176,064 on development of its N'Changa property, in Rhodesia, since incorporation of the company. Estimates based on the results of this work and drilling operations indicate the presence of nearly 15,000,000 tons of ore containing more than 3 per cent copper.

MAGMA COPPER COMPANY produced 9,138,167 lb. of copper during the quarter ended June 30, 1928, at a cost of 8.66c. per pound, after depreciation but before depletion or deduction for federal tax payments, and with gold and silver credited to copper. Production for the year 1927 was 28,502,521 lb. of copper. Cost per pound was 8.60c., before depreciation, in 1927.

MCINTYRE PORCUPINE MINES, LTD., reports results of operations during the quarter ending June 30, 1928, as follows:

	Quarter Ended June 30, 1928	Same Period Last Year
Gross recovery	$1,002,879	$894,167
Costs including development	570,559	522,641
Operating earnings	$432,320	$371,525
Non-operating revenue	24,183	20,969
	$456,504	$392,494
Less provision for taxes	22,020	16,351
Net earnings before depreciation	$434,484	$376,143

Rand Gold Output and Values for May

The following is the result of crushing during May, 1928, at seventeen leading gold mines of the Rand. The results are arranged in order of estimated profits:

	Tons Crushed	Value £	Costs per Ton s. d.	Estimated Profit £
Govert. Areas	208,000	394,892	15/10.8	235,384
New Modder	142,000	339,518	19/ 7.5	200,165
Crown Mines	230,000	314,194	19/ 8.8	87,260
Springs	72,500	146,344	20/ 1.5	73,402
Modder Deep	45,700	102,737	15/ 9.0	66,702
New State Areas	79,000	138,191	20/ 7.3	58,130
Brakpan	86,100	142,066	19/11.4	56,174
Van Ryn Deep	68,000	110,585	18/ 4.9	49,046
Modder B	70,000	110,889	18/ 0.8	47,653
Sub Nigel	22,800	.....	40/ 2.0	43,634
Geduld	82,000	111,699	16/ 9.0	43,019
Langlaagte Est.	86,000	110,585	20/ 1.7	25,037
West Springs	53,600	76,386	19/ 9.2	23,408
Randfontein	217,000	205,593	17/ 0.8	23,206
Consold. M. Rf.	61,500	97,988	25/ 1.4	20,756
Robinson Deep	78,800	.....	20/ 1.7	19,251
Modder East	61,000	81,404	21/ 3.3	16,503

ONTARIO DEPARTMENT OF MINES reports that the gold mines of Ontario show a decrease in production at Porcupine, but a record for Kirkland Lake in the aggregate value of crude bullion produced for June, 1928. For the half year the total value of bullion shows an increase over the corresponding period of 1927. The Hollinger mine has not yet recovered from disorganization resulting from the fire in February.

During June, producing mines in order of output were as follows:

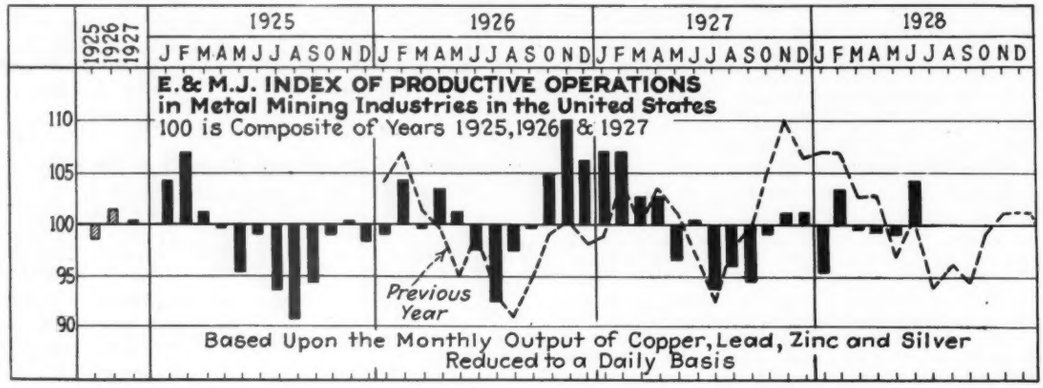
Porcupine: Hollinger, McIntyre, Dome, Vipond, Ankerite, March Gold, and Paymaster.

Kirkland Lake: Lake Shore, Teck-Hughes, Wright-Hargreaves, Sylvanite, Kirkland Lake Gold, Tough-Oakes Burnside, Barry-Hollinger, and Gold Hill.

June receipts of crude bullion at the Royal Mint, Ottawa, from twelve Ontario producers, totaled 128,305 ounces crude, containing 100,778 oz. of gold and 15,212 oz. of silver, having a total value of $2,092,346.

Indicators of Industrial Activity

of Significance to Mining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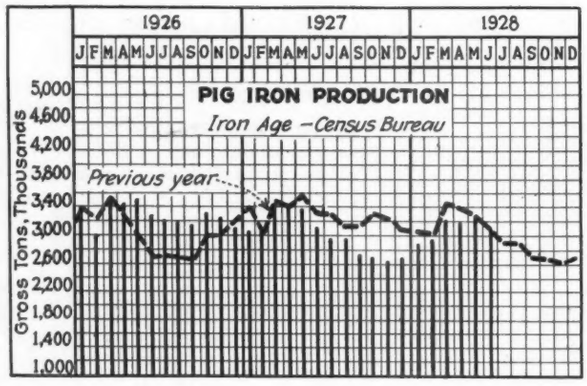
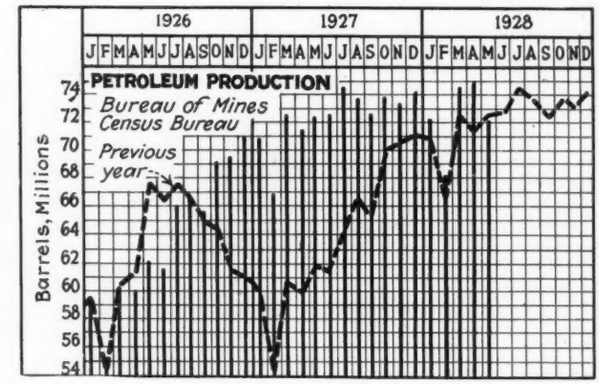
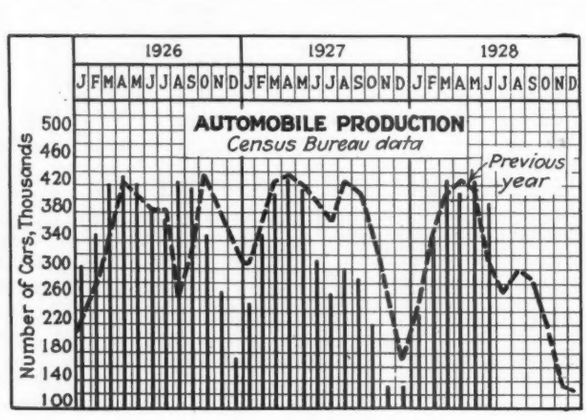
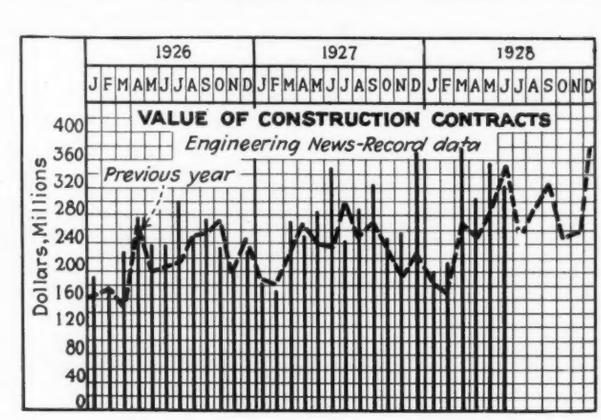
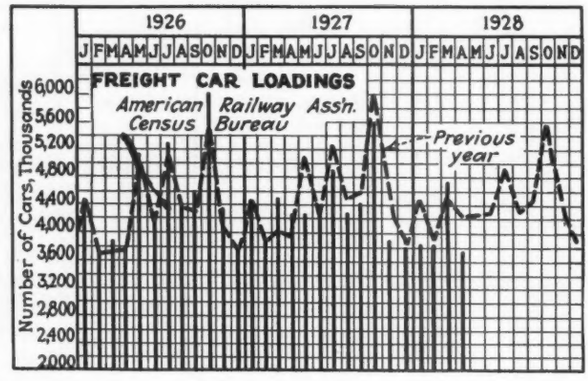
E.& M.J. INDEX OF PRODUCTIVE OPERATIONS
in Metal Mining Industries in the United States
100 is Composite of Years 1925,1926 & 1927
110
105
100
95
90
Previous Year
Based Upon the Monthly Output of Copper, Lead, Zinc and Silver
Reduced to a Daily Basis

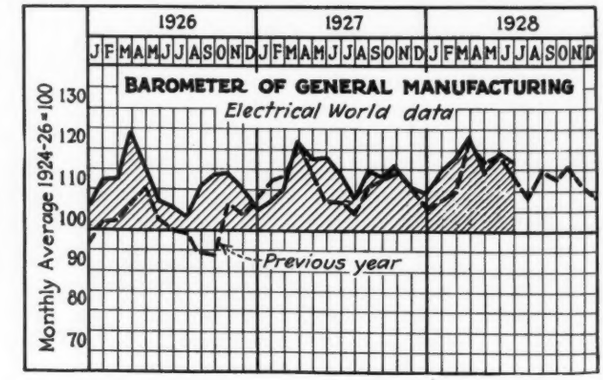












The Market Report

Metal Markets Listless, With Prices Unchanged

Silver, Tin, and Cadmium Quotations Fractionally Higher —Lead Most Active of Major Metals

New York, July 25—Market transactions in the non-ferrous metals offer but little to attract attention during the week ending today. Sales of copper are the smallest reported in several months, though most of the producers appear to welcome the respite, and not the slightest sign of price weakness is observed. Volume of lead buying was proportionally the largest of any of the metals, the aggregate being but slightly below average. Demand for zinc continues on the easy side, with prompt metal unchanged at 6.20c. per pound, East St. Louis. China's reversal of position, from seller to buyer, was largely responsible for an advance in the price of silver of nearly 1c. per ounce. Tin is firm at slightly higher prices, as is cadmium. Quicksilver, white arsenic, bismuth, antimony, and the platinum metals are unchanged as to price.

Daily Prices of Metals

July	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
19	14.525	47.625	6.20	6.00	6.20
20	14.525@14.55	47.50	6.20	6.00	6.20
21	14.525	47.50	6.20	6.00	6.20
23	14.525	47.75	6.20	6.00	6.20
24	14.525	48.00	6.20	6.00	6.20@6.25
25	14.525	48.00@49.00	6.20	6.00	6.20
	14.527	47.813	6.200	6.000	6.204

Average prices for calendar week ending July 21, 1928, are: Copper, 14.527; Straits tin, 47.302; N. Y. lead, 6.200; St. Louis lead, 6.000; zinc, 6.200; and silver, 58.833.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	63	63 5/16	68 1/4	218	213 1/2	20 11/16	21 1/8	24 5/8	24 7/8
20	62 7/8	63 1/4	68 3/4	215 5/8	212	20 3/4	21 1/4	24 5/8	24 7/8
23	62 13/16	63 3/16	68 3/4	216	213	20 13/16	21 1/8	24 5/8	24 7/8
24	62 13/16	63 3/16	68 3/4	217 1/2	214 1/2	20 13/16	21 1/8	24 11/16	24 7/8
25	62 13/16	63 5/16	68 3/4	218 1/2	215 3/8	20 7/8	21 1/8	24 3/4	24 7/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	4.86	58 7/8	27 1/8	84s10½d	23	4.85 5/8	59 5/8	27 7/16	84s10½d
20	4.85 7/8	58 5/8	27 1/16	84s10½d	24	4.85 5/8	59 1/2	27 5/16	84s10½d
21	4.85 5/8	58 3/4	27 1/8	.....	25	4.85 1/2	59 1/2	27 5/16	84s10½d
					Avg.	59.146			

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Very Quiet, Prices Unchanged

Dullness, a feature of the copper market since late June, was noticeable in even greater degree during the week ending today. This week's volume of sales is the smallest reported in any corresponding period since early March. That July would be a quiet month was not unexpected. Interpretation of June statistics as unfavorable to the producer and the effect of the continued hot weather are probable reasons for the lessening in demand. Sales on foreign account amount to approximately 30,000 tons so far this month, which reflects the domestic situation in being below average. Two small lots of copper for prompt delivery were reported; delivery specified on other sales represented August, September, and October in fairly even proportion. No sign of weakness in the 14¾c. per pound, delivered Connecticut Valley basis, price has appeared. Copper exporters' price remains at 15c., c.i.f. usual European destinations.

Lead Continues Steady

Though the volume of lead sales during the week has been in the aggregate slightly under the average, the inquiry has been steady and the tone of the market is good. Spot lead in London is a little stronger. The position of most producers is comfortable, and there is no tendency to shade the prevailing prices. These are: 6.20c. in New York, at which figure the American Smelting & Refining Company continues its contract price, and 6.00c. in St. Louis. Corroding grades command the usual premium of from $2 to $3 per ton.

Statistics for world production in June show that the rate (4,375 tons per day) is a little higher than that of either April or May, but substantially under the average for this year or for 1927. North America and Burma account for the greater part of the increase in June.

It is reported that the Interstate Commerce Commission has now given its approval to the reduction in rate from $7 to $5 per ton, applying to lead shipped from St. Louis to New York. It is understood that the Eastern Traffic Executive Committee proposed the reduction at the instance of prominent consumers of lead, and that the I.C.C. has recently held hearings on the proposal. Just what effect the change will have on the distribution of lead in the Eastern market is problematical. No reduction has been asked for with re-

spect to the rate on slab zinc, which is now $7 between the two points. However, the position of the two metals is different in many particulars.

Featureless Week in Zinc

Dullness in the market for Prime Western zinc is still quite pronounced. Price for prompt zinc continues unchanged, and, as the week draws to a close, there appears less tendency for producers to ask the $1 per ton premium on forward metal that has prevailed recently. One fairly large sale of slab zinc for October delivery was reported at 6.25c. per pound, and one seller was able to get that price for a small lot of August metal. Otherwise the price for prompt, 6.20c., prevailed on all transactions. High-grade quotations continue nominally at 7.50c. per pound New York.

Tin Prices Climb

Further advances have been made in the price of tin in London, though not so sharp as took place last Tuesday and Wednesday. It is reported that a strong pool with £200,000 at its disposal is supporting the market; the inference is that the reason behind this support is speculation in shares of tin mining companies. That the market is under artificial stimulus is indicated by the fact that with plenty of spot tin available there is a backwardation of £3, where there should be a contango. Domestic prices have advanced in sympathy with London. A good turnover is divided between dealer and consumer buying, with the former apparently predominating. This morning transactions were made at 48c., whereas 49c. was realized this afternoon.

Silver Higher and Strong

During the first half of the week the silver market remained quiet and idle with little change in prices. There was a sharp advance of $\frac{7}{8}$c., to 59$\frac{3}{8}$c., on July 23d, caused by a reversal of China's position and a good demand for India account. The market closes quiet and steady.

Mexican Dollars (Old Mexican pesos): July 19th, 44$\frac{3}{8}$c.; 20th, 44$\frac{1}{8}$c.; 21st, 44$\frac{1}{4}$c.; 23d, 45$\frac{1}{4}$c.; 24th and 25th, 45$\frac{1}{8}$c.

Foreign Exchange Steady

Sterling is a little weaker and German marks are a little stronger than a week ago. Closing cable quotations on Tuesday, July 24, were as follows: francs, 3.91$\frac{7}{16}$c.; lire, 5.23$\frac{3}{4}$c.; and marks, 23.87c. Canadian dollars, $\frac{3}{64}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, near-by, 9$\frac{1}{2}$c., futures, 9$\frac{1}{4}$c. Cookson's "C" grade, spot, 15$\frac{3}{8}$c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM—Per lb., New York: 70 @75c., according to quantity.

IRIDIUM — Per oz., $275@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.: electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75.50@$76.50 asked. Market very quiet.

QUICKSILVER — Per 76-lb. flask, $120@$122, depending on quantity. San Francisco wires $121.67.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of July 7.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn: 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the July 7 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.75@$11, Western scheelite, $10.75@$11.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the July 7 issue.

Joplin Zinc Ore Output Increased

Joplin, Mo., July 21, 1928

Blende	Per Ton
High	$42.25
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent	37.00@ 39.00
Average settling price, all zinc	39.28
Galena	
High	$83.75
Basis 80 per cent lead	80.00
Average settling price, all lead	82.92

Shipments for the week: Blende, 12,381; lead, 1,657 tons. Value, $623,700.

The production of zinc ore this week closely balanced the shipment, the decrease in reserve stock being less than 400 tons. Stocks of concentrate in the bins at the mills are less than 40,000 tons, approximately three-fourths of which is unsold. The output was increased this week and is expected to continue around 12,000 tons for several weeks, in order to return men to work, but the increase will be in the hands of companies financially able to hold it in reserve until needed.

Platteville, Wis., July 21, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$81.00

Shipments for the week: Blende, 275 tons; lead, none. Shipments for the year: Blende, 20,518 tons; lead, 1,245 tons. Shipments for the week to separating plants, 418 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the July 7 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market firm.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the July 7 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the July 7 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the July 7 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of July 7.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $15.75@$16; No. 2 foundry, $16.50@$16.75.

Steel—Base prices per gross ton, Pittsburgh, billets rerolling, $32; slabs, $32@$33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.60@$2.65. Connellsville foundry, contract, $3.50@$4.85; spot, $3.50@$4.50. Byproduct coke, Ohio and Kentucky $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended July 21, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	67	64⅛	66⅛	Jl.14, Au. 20 Q	1.00
Ariz. Com'l.	Boston	4⅜	4	4⅛	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz.	New York	96½	94½	96	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	22	21½	22	My. 31, Je. 15 Q	0.50
Cerro de Pasco	New York	74½	73	74½	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	45⅝	43⅛	45⅛	Je.6, Je.30 Q	0.62½
Con. Coppermines	N. Y. Curb	10⅛	9⅞	10⅛		
Copper Range	Boston	18	17½	18	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*38	*34	*35		
East Butte	Boston	2⅜	2⅜	2½	Dec., 1919	0.50
Granby Consol.	New York	52⅝	51⅛	52½	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	101	96½	98⅛	Je. 15, Jl. 2	1.00
Howe Sound	New York	57⅛	55½	57⅛	Je.30, Jl.16, Q	1.00
Inspiration Consol.	New York	21⅝	21⅛	21⅛	Apr. 1927 Q	0.25
Isle Royale	Boston	17⅛	17	17⅛	Fe.28, Mr.15 SA	0.50
Kennecott	New York	93⅜	90⅛	93⅛	Jl. 1, Jl. 2 Q	1.25
Magma Copper	New York	49⅝	48⅛	49⅛	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1 1/16	1⅛	1⅛		
Miami Copper	New York	20⅛	19⅛	19⅜	Au.1, Au.15, Q	0.37½
Mohawk	Boston	58	56½	57½	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*30	*23	*23		
Mother Lode Coal	New York	2⅜	2⅛	2⅛	Je.8, Je. 30, SA	0.15
Nevada Consol.	New York	22⅛	21⅜	22⅛	Je.15, Je.30 Q	0.375
New Cornelia	Boston	29	28	29	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	60⅛	49½	57⅛		
North Butte	Boston	3⅛	3	3⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*76	*72	*72	Sept., 1926	0.03
Old Dominion	Boston	15⅛	14⅛	15⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	133⅛	133⅛	133⅛	Je.25, Jl.22 Q	2.00
Quincy	Boston	40	37⅛	39	March, 1920	1.00
St. Mary's Min. Ld.	Boston	28	27	28	Ap.1928 A	2.00
Seneca Copper	New York	2⅛	2⅛	2⅛		
Shattuck-Denn	N. Y. Curb	16	13½	15		
Tenn. C. & C.	New York	13⅜	13⅛	13⅜	My.29, Je.15,Q	0.12½
United Verde Ex.	N. Y. Curb	16⅛	15⅛	16⅛	July 6, Q	0.50
Utah Copper	New York	152	152	152	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.27½	1.25	1.25		
NICKEL-COPPER						
Internat. Nickel	New York	93⅛	87⅛	91⅛	Je.14, Je.30 Q	0.50
Internat. Nickel pfd.	New York	116	116	116	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn.	Spokane	*3½	*2⅛	*3	June, 1927	0.005
National Lead	New York	118	118	118	Je.15, Je.30 Q	1.25
National Lead, pfd. A	New York	144½	144½	144½	Je.1, Je.15 Q	1.75
National Lead, pfd. B	New York	122	122	122	Jl. 20, Au. 1 Q	1.50
St. Joseph Lead	New York	42	39⅛	40	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	25⅛	23⅛	25⅛	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	83	81⅛	82⅛	Nov., 1920	1.50
Butte C. & Z.	New York	6⅛	6⅛	6⅛	De., 1926	0.50
Butte & Superior	New York	11⅛	10⅛	11⅛	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3	2⅛	2⅛	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	15⅛	13	13	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	17⅛	17	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati	...	...	100	Mr. 31, Ap. 16 Q	1.50
New Jersey Zn.	N. Y. Curb	216	212	215	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	18.40	18.25	18.40		
United Zinc	N. Y. Curb	*70	*70	*70		
Yellow Pine	Los Angeles	*30	*25	*30	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4⅛	3⅞	4		
Ankerite	Toronto	...	...	*40		
Barry-Hollinger	Toronto	*61	*56	*57½		
Central Manitoba	Toronto	1.08	1.00	1.02		
Cresson Consol. G.	N. Y. Curb	1⅛	1	1⅛	Je.30, Jl.10 Q	0.10
Dome Mines	New York	8⅜	8⅛	8⅜	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.68	†1.67	....	My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*9	*7	*8		
Hollinger Consol.	Toronto	12.70	10.50	11.65	Jl.25, Au.11 MO	0.10
Homestake Mining	New York	73⅛	73⅛	73⅛	Jl.20, Jl.25 M	0.50
Kirkland Lake	Toronto	1.60	1.43	1.54		
Lake Shore	Toronto	22.50	21.75	21.75	Je.1, Je.15 QX	0.20
McIntyre Porcupine	New York	22¼	22⅛	22⅛	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*20	†*19	....	Ap., 1927	0.02
Rand Mines	New York	...	...	39½	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	2.50	2.20	2.25		
Teck-Hughes	Toronto	10.65	9.50	9.60	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*43	*42	*43	Dec., 1926	0.02
Tough-Oakes	Toronto	*26	*21	*21½		
Vipond Cons.	Toronto	*53	*48	*48	April, 1927 Q	0.03
Wright-Hargreaves	Toronto	3.58	3.00	3.20	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	18⅜	18⅛	18⅜		
Con. Cortez	N. Y. Curb	*25	*23	*23		
Dolores Esperanza	N. Y. Curb	1⅛	*98	1	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	...	...	15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2	2⅛	Je.14, Jl.3	0.06
Tonopah Belmont	N. Y. Curb	1	*90	*90	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*13	*13	*13	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	5⅛	4⅞	5⅛	Mar.31,Ap.21 SA	0.07½
West End Consol.	N. Y. Curb	...	...	*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	*67	*67	*67	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	*94	*89	*93	May, 1920	0.03
Castle-Trethewey	Toronto	*47⅛	*46	*47	....	....
Coniagas	Toronto	4.96	4.90	4.90	May, 1924	0.12½
Keeley	Toronto	*62	*62	*62	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	....	....	*50	July, 1925	0.05
Mining Corp. Can.	Toronto	3.59	3.45	3.45	My.20, Je.13 SA	0.12½
Nipissing	N. Y. Curb	3⅜	3⅛	3⅛	Je.30, Jl.20Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅛	3⅛	Ap., 1927	0.12½
Bingham Mines	Boston	44	43	44	Je.23, Jl.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	135	135	135	Je.30, Jl.5 QX	0.75
Cardiff M. & M.	Salt Lake	*63	*62	*62	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	4.12½	4.10	4.15	Ja.10, Fe.1 K	0.10
Consti'nMng.&Mill'g.	Spokane	*26	*20	*26		
Erupcion	Boston Curb	....	....	*28	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.20	2.10	2.17½		
Federal M. & S.	New York	...	...	125	Je., 1927	10.00
Federal M. & S. pfd.	New York	...	...	98	My.25, Je.15 Q	1.75
Hecla Mining	N. Y. Curb	15⅛	14⅝	15⅛	My.15, Je.15 Q	0.15
Highland-Surprise	Spokane	*12	*10	*10		
Iron King Mining	Salt Lake	*72	*66	*69		
Keystone Mining	Salt Lake	†*20	†*19	....	Fe., 1926	0.07½
Lucky Jim	Spokane	*32½	*30½	*32½		
Lucky Tiger-Com.	Kansas City	†7.70	†7.50	....	Je.7, Je.20MX	0.07
Mammoth Mining	Salt Lake	†1.65	†1.37	....	De., 1926	0.25
North Lily	Salt Lake	7.75	7.60	7.60		
Park Utah	New York	11⅛	11	11⅛	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	†2.50	†2.13	....	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*49	*43	*47	June 15 Q	0.03
Silver King Coal	Salt Lake	12	12	12	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*13	*11⅛	*11⅛	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*98	*79	*96		
Sunshine M. Co.	Spokane	1.38	1.35	1.38	June 20,	0.02
Tamarack-Custer	Spokane	*51	*47	*47	Sept., 1924	0.25
Tintic Standard	Salt Lake	14	13⅜	13⅜	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	4⅛	3⅞	3⅞	Jl.14, Au.1 1926	0.25
IRON						
Bethlehem Steel	New York	56⅛	53	54⅜	Jl., 1924	1.25
Cleveland-Cliffs Iron.	Cleveland	110	104	109	Jl.14, Jl.25. Q	1.00
Colorado Fuel & Iron	New York	64⅜	57⅜	62	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	21	20⅛	20⅛	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	55	54	54	My. 15, Je.1 Q	0.62½
Republic I. & S.	New York	55⅛	52⅛	55	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd.	New York	105	105	105	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I.	New York	111	104	111	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd.	New York	...	...	115½	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	139⅛	134⅛	138⅛	My.31, Je.29 Q	1.75
U. S. Steel, pfd.	New York	141⅛	141	141	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C.	New York	...	...	14⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	52⅛	52⅛	52⅛	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York	...	...	25⅛	July., 1927	1.45
So. Am. G. & P.	N. Y. Curb	....	....	3⅛	....	....
Alum. Co. of Amer.	N. Y. Curb	138	138	138		
Alum. Co. of Amer. pf.	N. Y. Curb	108	107⅛	108	Je. 15, Jl. 1 Q	1.50
Vanadium Corp.	New York	73⅜	68⅛	72	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	30⅛	29	30⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp.	Montreal	30⅛	30	30⅛	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	92⅛	92	92⅛	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	69	60⅛	60⅛	Jl.14,Au.1 QX	1.75
Texas Gulf	New York	68⅛	66⅛	67	Je.1, Je.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48	47⅛	47⅛	Au. 21, Se.1 Q	0.75
Amer. Metal, pfd. 6%	New York	112⅛	111⅛	111⅛	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York	...	...	125	My.15, Je.1	1.75
Amer. Sm. & Ref.	New York	190⅛	187½	190⅛	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	135	133	133⅛	Au. 3, Se. 1 Q	1.75
Consol. M. & S.	Montreal	252⅛	250	252	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	157⅛	151⅛	157	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M.	New York	46⅛	46	46	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	53⅜	52⅜	52⅜	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED July 11, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	37/6	37/—	37/6			
Alaska Treadwell ($25)	122/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	60/3	58/6	60/—	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/3	14/—	14/1½	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	5/1½	4/9	5/1½			
Camp Bird (2s)	4/6	3/10½	4/—	April, 1928	16½ p.c.	
El Oro (£1)	4/7½	4/1½	4/6	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	12/6	10/3	11/3	Jan., 1928	5 p.c.	
Mexican Corpn. (£1)	10/4½	9/10½	10/3			
Mexico Mines of El Oro (£1)	26/3	17/6	20/—	Dec., 1926	3½ p.c.*	
Mond Nickel	180/7½	170/—	177/6	Aug., 1928	20 p.c.	
N'Changa Copper Mining	16/10½	15/7½	16/—			
Oroville Dredging (£1)	3/9	3/7½	3/9	Dec., 1923	3½ p.c.	
Rhodesian Congo Border (£1)	37/6	34/4½	35/—			
St. John del Rey (£1)	12/1½	11/3	12/—	April, 1928	7½ p.c.	
San Francisco Mines (10s)	28/9	28/—	28/6	July 1928	12 p.c.	
Santa Gertrudis (£1)	16/7½	16/—	16/3	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	11/3	10/—	10/9	April, 1917	6½ p.c.	
S. Amer. Copper (2s.)	2/7½	2/3	2/3	Nov., 1917	75p.c	
Tanganyika (£1)	59/1½	53/9	56/3	Aug., 1927	7½p.c	
Union Miniere de Haut-Katanga (Brussels)	11,100	10,525	10,625	July, 1927	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.

Current Prices of Mining Supplies

Rise and Fall of the Market

CAST-IRON pipe continues in its upward course, having advanced $1 per ton at principal mill points during the last week. Rope, timbers and galvanized sheets advanced during July. Wire nails and linseed oil prices are below those of a month ago, while a dull rubber market is reflected in lower quotations on hose, packing and belting.

SHEETS—Quotations are per 100 lb. in various cities delivered from warehouse, also the base price at mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.50@$3.75	$5.10	$4.80	$5.30	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham in carloads:

	Pittsburgh	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00
Standard open hearth rails	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for large mill lots, together with the warehouse prices at other places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	4.55	4.65@4.77	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	3.40	3.62	4.25	3.00

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in large mill lots, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations are per 100 lb., delivered from warehouse:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$2.05	$3.30*	$3.50	$3.25	$3.10	$3.25
Channel, 3 to 15 in.	1.85	2.05	3.30*	3.50	3.25	3.10	3.25
Angles, 3 to 6 in., ¼-in. thick	1.85	2.05	3.30*	3.50	3.25	3.10	3.25
Tees, 3 in. and larger	1.85	2.05	3.30*	3.50	3.25	3.10	3.25
Plates ¼-in. thick	1.85	2.05	3.30*	3.50	3.25	3.10	3.25

*250 to 3,999 lb.

WIRE ROPE—Discounts from list price, f.o.b. New York and territory east of Missouri River on regular grades of bright and galvanized, are as follows:

Cast steel round strand rope	20 %
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5 %
Plow steel round strand rope	35 %
Special steel round strand rope	30 %
Gavanized iron rigging and guy rope (add to list)	12½%

MANILA ROPE—Per lb., ¼-in. and larger, delivered in 1,200-ft. coils:

Atlanta	$0.25	New Orleans	$0.23½
New York	.24	Seattle	.21½
Chicago	.21	San Francisco	.21½

DRILL ROD (from list at warehouse): New York 60% | Cleveland 55% | Chicago 50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are for large mill lots at Pittsburgh mill:

	Steel			Iron		
	Inches	Black	Galv.	Inches	Black	Galv.
Butt Weld	⅛ to 3	62	50½	⅛ to 1¼	30	13
Lap Weld	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in., lap welded	45%	51%	46%

CAST-IRON PIPE—The following are prices on bell and spigot pipe, Class B and heavier, f.o.b. per net ton, for large mill lots.

	Birmingham	New York	Chicago	St. Louis	San Francisco
6 in. and over	$34.00	$39.60	$42.20	$39.60	$44.00

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full packages, discount 50% from latest list, April 1, 1927, at warehouses in New York and vicinity

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, carry a discount of 55% from latest list, April 1, 1927, on immediate deliveries from warehouse stocks in New York and vicinity.

HOLLOW TILE—Price per block to contractors, in lots of 2000 pieces or over:

	New York	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.0973	$0.076	$0.11	$0.078	0.108	
6x12x12	.1459	.104	.....	.105	.156	$0.252*
8x12x12	.1824	.142	.22	.145	.255	.312†

*10x12x12; †12x12x12.

LUMBER—Price per thousand feet, board measure, for timbers:

San Francisco—Rough Douglas fir, No. 1 common, at yards:

	10-16-18 and 20 Ft.	22 and 24 Ft.
3x3 and 4	$28.00	$29.00
3x6 and 8	28.00	29.00
3x10-6 and 12	28.00	29.00

New York—Prices are for long-leaf, yellow pine timbers (rough) at wholesale, in quantities of 35,000 ft. or more, within lighterage limits:

	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$41.00@43.00	$42.00@44.00
3x10 to 10x10	48.00@50.00	49.00@51.00
3x12 to 12x12	55.00@57.00	56.00@58.00

Chicago—Prices in carloads, f.o.b., for long-leaf, yellow pine timbers, No. 1 and Douglas fir, No. 1:

	Up to 20 Ft., Pine	Up to 32 Ft., Fir
3x4 to 8x8	$38.00	$41.50
3x10 to 10x10	46.50	41.50
3x12 to 12x12	56.50	41.50

Other Cities—Price for rough timbers delivered:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$48.00	$47.00	$47.50	$50.00	$56.25	$50.00
Cincinnati	33.00	46.00	44.00	44.00	37.00	54.50
Denver	.....	31.25	.....	.....	.....	45.00
Minneapolis	53.00	48.25	36.25	.....	55.00	49.25
Kansas City, Mo.	39.00	39.75	.....	.....	52.00	48.75
Philadelphia	55.00	37.00	42.00	43.00	65.00	50.50

* Douglas Fir.

NAILS—The following quotations are per 100 lb. keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.55@$2.65	$3.10	$3.60	$4.00	$2.75	$4.95
Cut	2.80	.....	5.00	5.00	.....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@$2.35	$2.25@$2.35	$2.35
Chicago, f.o.b.	2.05	2.05	2.05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Delivered: New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$21.00@22.00	$14.00@15.00	$4.00@4.10	$3.15@3.25
Chicago	20.00	18.00	.....	1.50

LINSEED OIL—These prices are per pound:

	New York	Chicago	Minneapolis
Raw in barrels (1 to 4 bbl. lots)	$0.11	$0.108	$0.115

WHITE AND RED LEAD—Per 100-lb. keg base price, f.o.b. New York.

	Dry	In Oil
Red	$13.25	$14.75
White	13.25	13.25

HOSE—Quotations at New York warehouses:

Fire Protection: Underwriters' 2½-in. coupled, single jacket (net) — 50-Ft. Lengths $0.60 per ft.

Air—Best Grade: ¾-in., per ft. — 3 ply $0.30 — 4 ply $0.36

Steam—Discounts from List: First grade 40% — Second grade 45% — Third grade 50–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:

Best grade 50% — Second grade 60%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply, at New York warehouses:

Grade	Discount from list
Medium	30–10%
Heavy	25–5%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet wire insertion	.75

EXPLOSIVES—Prices per pound for dynamite delivered in small lots:

	Gelatin 40%	Gelatin 60%
New York (special gelatin in case lots)	$0.26	$0.2825
Minneapolis	.1967	.2173
Denver (f.o.b.)	.1925	.215
Seattle	.16	.185
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.08½@.09
Litharge, casks	.08½
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06